The Electrical Industry's Weekly Magazine July 20, 1959

Electrical World

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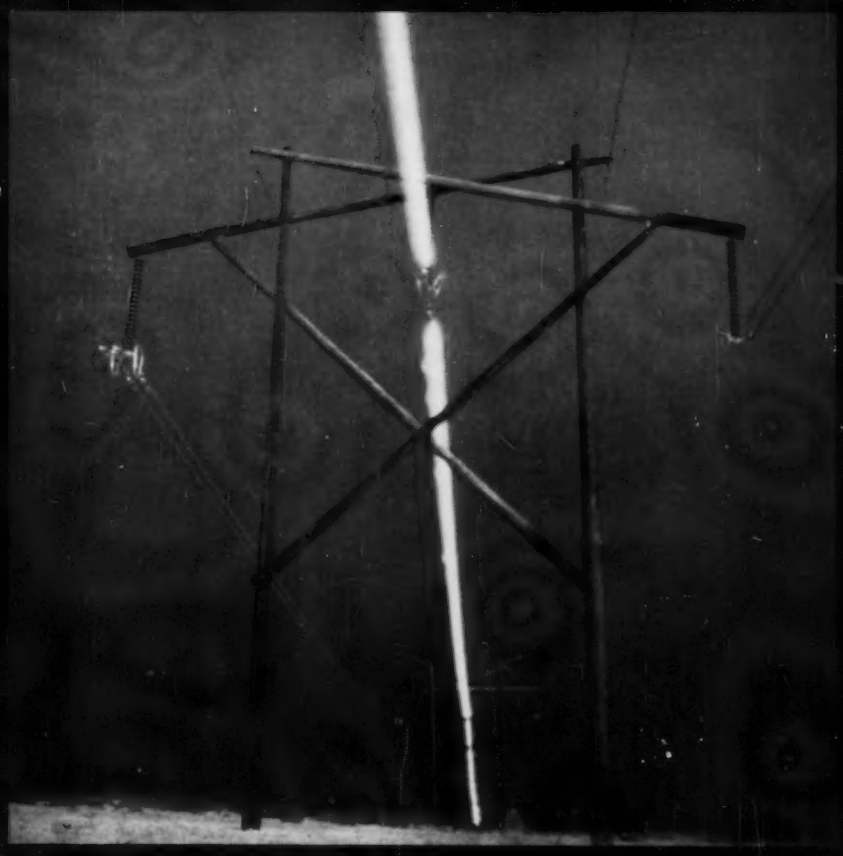
Co[illegible] Photo[illegible] Aid EHV Research



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STEVENS MICE GS W
UNIVERSITY MICROFILMS I
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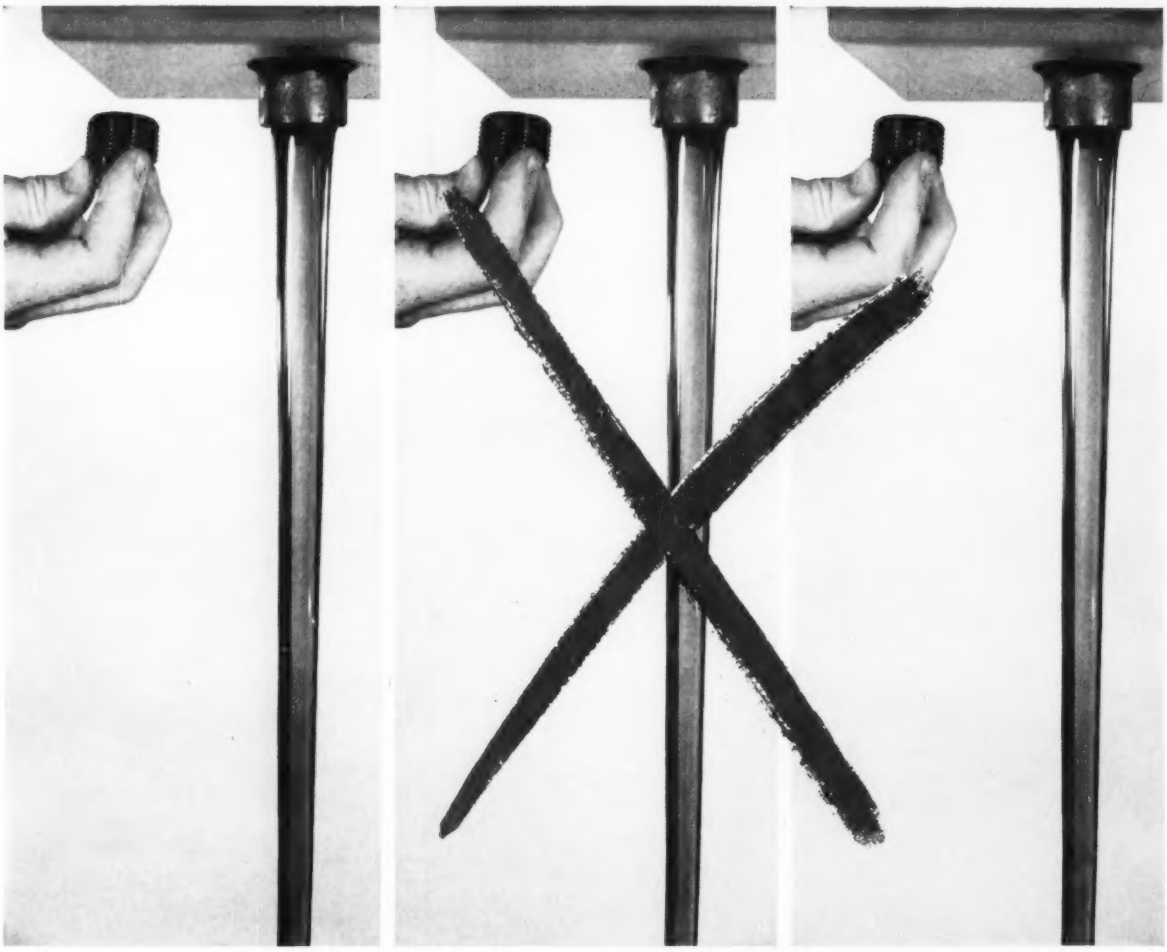

HOW TO CUT DRAIN PERIODS,
yet improve hydraulic performance!

Drain periods for a hydraulic system may be extended many times over by switching from straight mineral oils to a premium oil.

This has been proved time and again when the switch has been made to Texaco Regal Oil R&O without altering any other operating conditions.

It's obvious that draining hydraulic systems, cleaning, and replacing with new oil is costly. If one or more drainings can be eliminated the additional oil cost would be warranted.

Straight mineral oil may be satisfactory for some systems, but tests show that Regal Oil R&O can extend the interval between draining at considerable savings. This premium oil is formulated to resist oxidation, rust, foam, and wear.

And there's a bonus! When you do drain, you'll find the system in cleaner condition. Save again on make-ready.

The advantages of switching to Regal Oil R&O are so convincing that Texaco has made a film about it. We'll be happy to arrange a showing at your plant without obligation. Call the nearest of the more than 2,300 Texaco Distributing Plants, or write to:

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CONSTANT PROGRESS IN OIL'S FIRST CENTURY

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Electrical World

Vol. 152, No. 3 JULY 20, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Kariba Dam: Big Test of Men and Machines

Despite heat, floods, and transport problems, big South African project runs months ahead of schedule.....p 85

GENERATION

How Supercritical Cycle Boosts Efficiency

S. W. W. Mitchell, Westinghouse Electric Corp

Steam plant designers today have new methods for building in higher efficiency to offset rising fuel costs.....p 92

TRANSMISSION

Photos Show EHV-Line Noise Sources

L. M. Robertson, PS of Colorado; J. E. O'Neil, Westinghouse Electric Corp

Fast film supplies detailed data on corona and arcing on Leadville EHV conductors, ground wires, hardware.....p 90

Staff Report

Two Get Lamme Medal at AIEE Summer Meet

Beckwith and Alger share honor. Foote to succeed Hickernell as AIEE president. Highlights of technical sessions:

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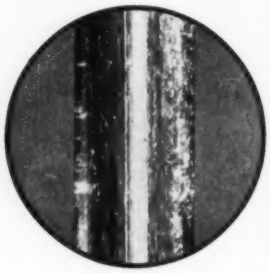
There is a Clear Relationship Between the Cleanliness of a Paper Cable's Components and its Ultimate Reliability . . .

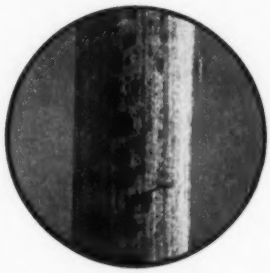
Immaculate cleanliness is an absolute "must" in every aspect of paper cable manufacturing. Take, for example, Okonite's special attention to conductor strands. An extra operation cleans them prior to their being made into a conductor. Each wire is pre-cleaned—thoroughly "washed" and "scrubbed" before it enters the stranding machine. This process removes dust and metal particles, but most important of all it also removes the residual soap and tallow lubricants common to all wire drawing operations. Such impurities, when combined with a cable's impregnating oil, can cause deterioration of the paper insulation and subsequent failure of the cable.

R. C. Waldron
Manager of Engineering

Okonite's painstaking cleanliness measures, also, help maintain the original low power factor of Okonite Paper Cables. For this reason, even the metal binder tapes used in Okonite cables are thoroughly pre-cleaned—just the same as the conductor strands. In fact, every practical effort is exerted to make the components of Okonite Paper Cables as clean as possible.



cleaned strand



uncleaned strand

. . . might mean the difference between success or failure

Properly-shaped Sector Conductors Contribute to the Life Expectancy of Paper Cables

Since voids in a paper cable's insulation can cause cable failure, it is essential to eliminate every possible source of their occurrence. One source of "void" trouble is the shape of ordinary sector conductors. Because their flat surfaces make it difficult to wrap paper tapes tightly around them, the tapes do not "hug" the entire surface of the conductor. They tend to merely contact the flat areas "loosely" or not at all. Therefore, not only can voids develop between the flat surfaces and the first layer of insulation, but—due to the "slack"—they also tend to appear in the wall of insulation itself.

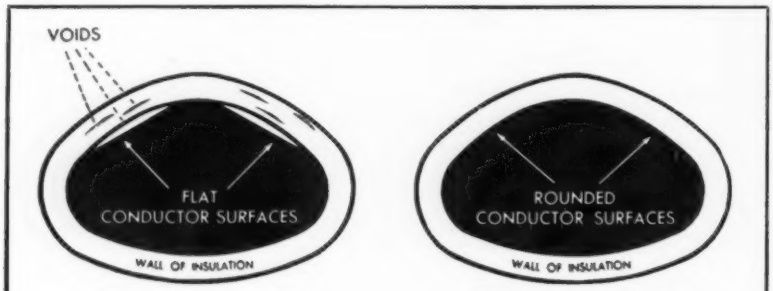
Realizing this flat surface "danger zone" existed in ordinary sector shape conductors, Okonite engineers designed conductor shaping dies that would form a continuous, convex surface about the entire circumference of sector conductors. As the accompanying diagram shows, the new Okonite sector design insured that each layer of paper tape would fit snugly around the conductor. Therefore, "danger zone" voids were effectively eliminated.

1. Carefully cleaning the cable's components, and
2. the development of an improved sector conductor . . .

. . . two concrete illustrations of the meticulous care that Okonite exerts over its paper cable manufacturing operations. This is all evidence to the fact that Okonite paper cables contain *added values*, values that are not written into specifications.

Today, every good engineer I know is seeking ways to get the maximum value out of the money he invests for his company or client. The *added values* in Okonite paper cables provide an opportunity to get extra life and dependability out of electrical cable systems. As one engineer to another, I urge you to become better acquainted with the long range economy of Okonite paper cables.

If you have not received your copy of the new Okonite paper cable catalog, or if I can be of help to you with a current problem, please get in touch with me at The Okonite Company, Passaic, N. J.



Ordinary sector shape

Flat surfaces . . . "slack" in paper tapes . . . voids . . . cable failure

Okonite sector shape

Continuous convex surfaces . . . snug fitting paper tapes . . . solid wall of insulation . . . long life, reliable service

8057

***where there's electrical power . . . there's* OKONITE CABLE**

In the Industry

Pioneers Needed for Patio Heating

Electric heating for outdoor patios is now making an appearance in the Pacific Northwest. Reports tell of one utility which is testing various electrical units for this purpose, and another utility that is already promoting patio heating.

Here is a market worth considering. For the homeowner, patio heating offers the opportunity for more comfort and extended use of a favorite family living space. For the utility, it offers a tempting opportunity to fill in the load valleys that occur in the fall and spring.

But this market is not one that will come on a silver platter. The wide-awake gas boys in some areas of the country are already wise to it. They have made a few commercial installations and are probably eying the rich home market.

Electric utilities stand to benefit most from this opportunity by guiding the development and application of effective devices for this new use. The flexibility of electric heating gives them some nice advantages.

This seems to us to be one of those areas where the rewards go to the pioneers.

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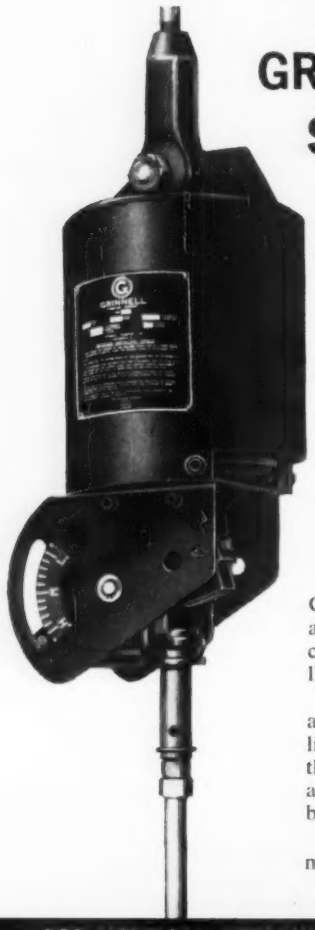
GRINNELL CONSTANT SUPPORTS...



2 BASIC DESIGNS...

11 DIFFERENT METHODS OF ATTACHMENT

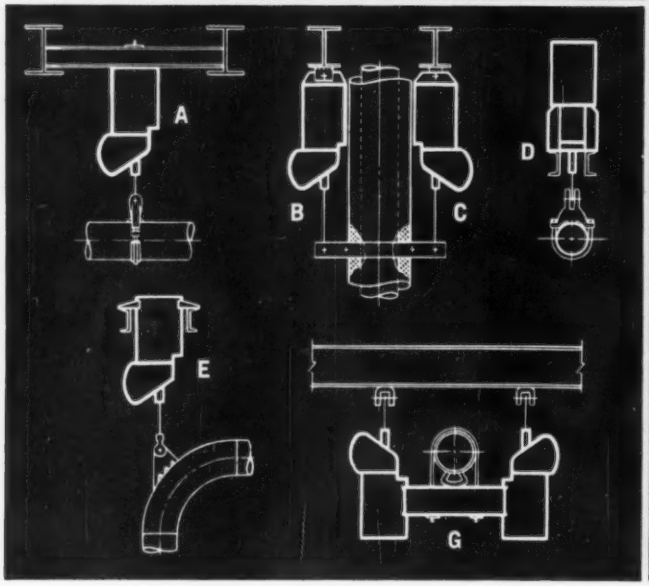
Grinnell Constant Supports are available in a range of sizes to provide capacities for loads from 27 lbs. to 57,500 lbs., with travels up to 16 inches.

Both vertical and horizontal hangers are designed to operate in extremely limited space. In the selection of types, there is a choice of 11 methods of attachment to structures—either above, between, or below supporting steel.

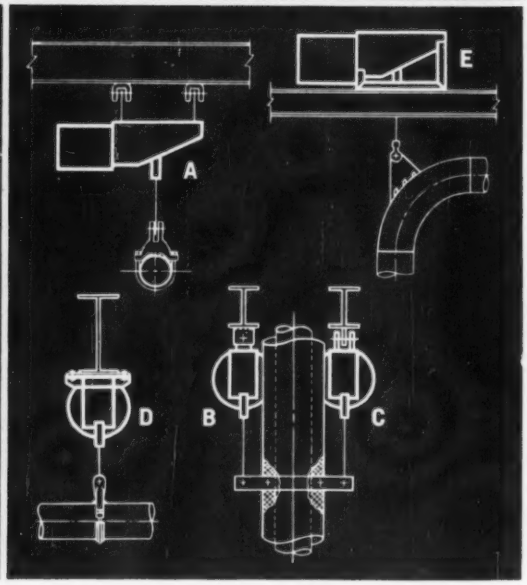
Grinnell Constant Supports provide mathematically perfect load support throughout all positions of travel . . . also a full 70 percentage points of adjustability is built into them. No less than 10% of this adjustability is allowed either side of calibration for plus or minus change in load. Field readjustments are easily made by turning a single load adjustment bolt.

Call on Grinnell's Pipe Suspension Department for help with your pipe suspension problems. Grinnell Company, Providence 1, Rhode Island.

FOR VERTICAL ATTACHMENT



FOR HORIZONTAL ATTACHMENT



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AMERICA'S No. 1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Today's smallest two-way mobile radio - actual size!

New General Electric Transistorized Progress Line

General Electric's new Transistorized Progress Line will fit in more places, in more different positions, than any other two-way mobile radio you can buy today.

Not only is this the world's smallest, lightest commercial two-way mobile radio, but standby battery drain is so low you need never turn off your TPL mobile unit, just like the clock in your car. You install no special generator, use less gas, require fewer engine jobs.

TPL is the first two-way radio that transmits up to 75 watts of power in high band . . . the first that really fits under the dash . . . the first to realize the full benefits of transistorized design (no more than four tubes) . . . the first to eliminate bulky cables through new one-piece design of receiver control and transmitter . . . the first with shielded dirt-free ventilation.

The new General Electric TPL ushers in a new era of convenience and reliability in mobile communications. Don't miss all the exciting details. Write General Electric Company, Communication Products Department, Section 979-20, Mountain View Road, Lynchburg, Virginia.

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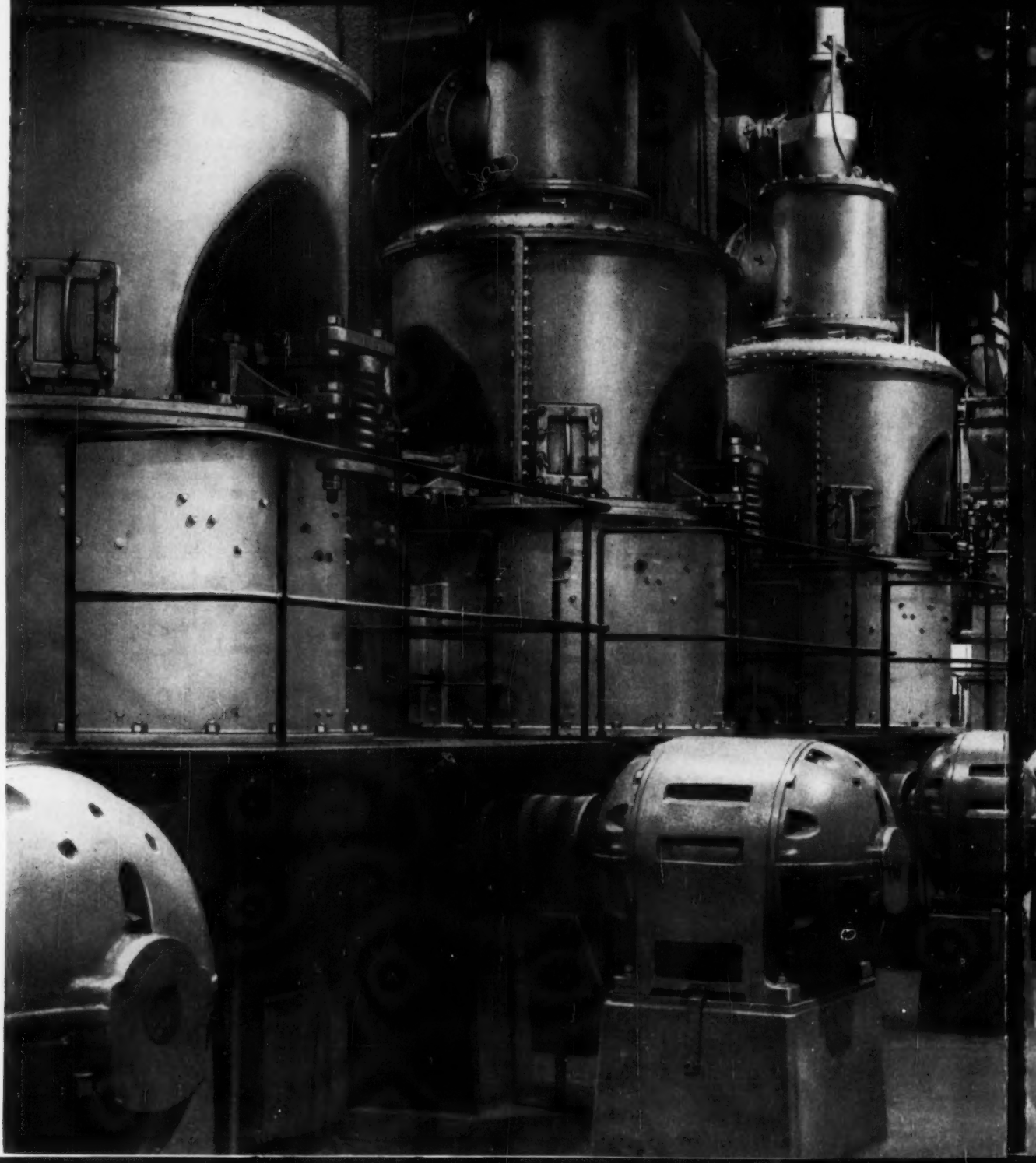
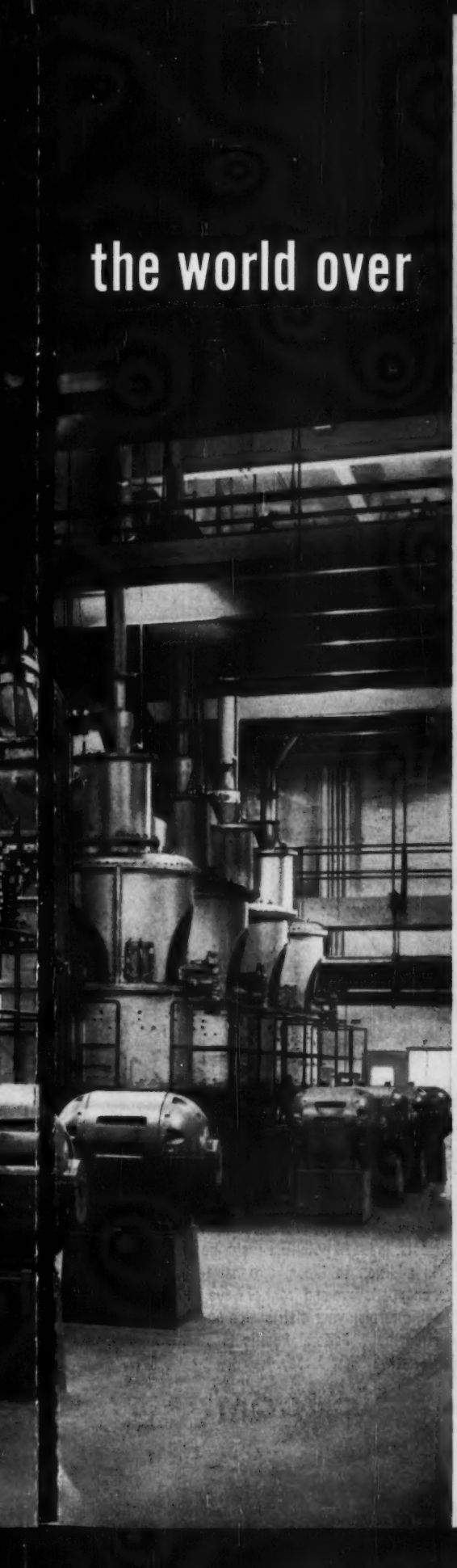
BOWL MILLS LIKE THESE

prepare the daily BTU diets of boilers





the world over

C-E RAYMOND BOWL MILLS pulverize lignite in Mallorca, Spain ... coke in Buenos Aires ... semi-bituminous coal in Limburg, Holland ... bituminous in Tanagawa, Japan ... furfural residue in Tennessee ... and petroleum coke in Indiana. But their biggest field of application, by far, is pulverizing various kinds of coal in hundreds of American utility plants from coast to coast. In all, they feed the boilers of the world with some 37,000 tons of fuel each hour — boilers with an aggregate steam generating capacity of about ...

400,000,000 lb. per hr.

There are eight big reasons why the C-E Raymond Bowl Mill is so popular — reasons that are important to you if pulverized fuel is part of your plant picture. They are ...

1. **Handles High Moisture Fuels** — High moisture fuels are handled without difficulty because the Bowl Mill premixes raw coal with the dried product in an atmosphere up to 700 F air. Even lignite with 50% moisture is thoroughly dried.
2. **Low Power Consumption** — Rapid flow of material through the mill, prompt removal of fine coal, fast drying and relatively low weight of grinding elements all combine to assure minimum power consumption.
3. **Continuous Service** — The Bowl Mill provides continuous service for long periods because there is no metal-to-metal contact between rings and rolls and wear is minimized. Logs showing 20,000 hours of continuous operation are not uncommon.
4. **Low Maintenance** — Maintenance is required less frequently because the Bowl Mill stays in service for longer periods. When replacement of parts is necessary, outage time is minimized because of the ease with which the machine can be taken apart and reassembled.
5. **Fineness Control** — Changes in fineness control can be made while the Bowl Mill is operating because the necessary adjustments are made from the outside. The mill need not be stopped.
6. **Automatic Grinding Adjustment** — Grinding pressure is automatically adjusted to suit fuel characteristics because the Bowl Mill uses spring-loaded journals which instantaneously compensate for variations in coal grindability.
7. **Infrequent Lubrication** — Only infrequent lubrication is required with the Bowl Mill. When required, it can be done from outside the mill without taking it out of service.
8. **Vibrationless-Quiet** — The Bowl Mill's grinding rollers make no metal-to-metal contact with the grinding ring, assuring quiet, vibrationless operation.

Whether you are considering pulverizers for your present plant expansion program or for future requirements, we suggest you investigate the advantages of the Bowl Mill as outlined above and described more fully in our Catalog PC-8.

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C-229

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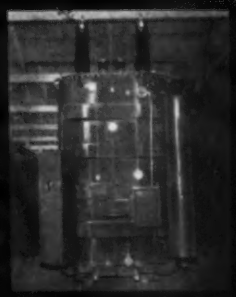
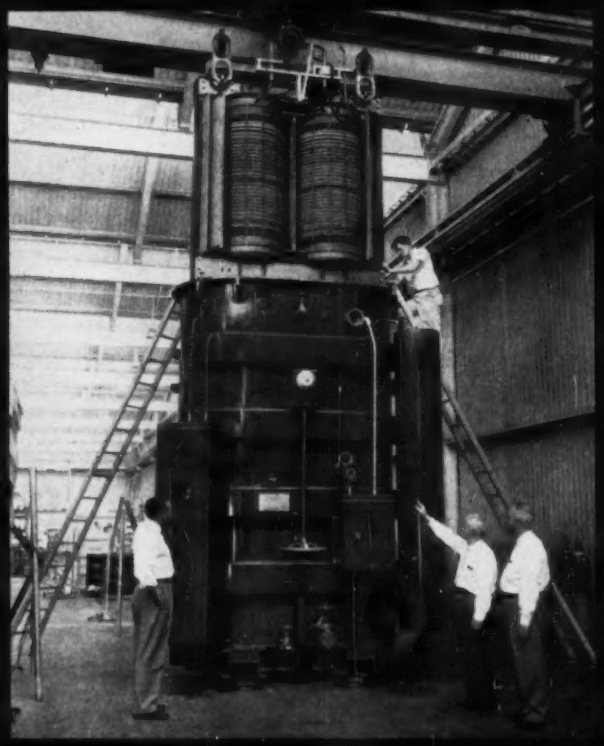
ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Federal Pacific offers nationwide delivery ...on a full line of transformers





60th year of transformer manufacturing progress... from 10 kva to 10,000 kva

To California...to Florida...to Iowa...to New York...new Federal Pacific Transformers are rolling out to new installations throughout the country. Typical is this 3333 kva, 115 kv single phase Type LS power transformer, one of four transformers forming a 10000/12500 kva bank and spare recently shipped to Florida.

FPE TAILORS TRANSFORMERS TO YOUR NEEDS...This unit includes nitrogen pressure equipment for oil preservation, removable radiators, terminal box for control wiring, interchangeable ASA Standard High Voltage Bushings, bushing type current transformers and ASA standard accessories.

FPE TRANSFORMERS SURPASS SPECIFICATION REQUIREMENTS ...Before shipment each rugged, soundly-built FPE transformer is thoroughly tested to meet all NEMA and ASA standards. Standard tests include: resistance measurements of all windings, ratio tests at all tap positions, polarity, exciting current, impedance, applied potential tests, induced potential tests, no load and full load loss tests. In addition to these, optional tests available include: full wave, chopped wave and front of wave impulse tests. Having Federal Pacific furnish your distribution and power transformers is sound judgment. Federal Pacific Electric Company, General Offices: Newark 1, New Jersey.

FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment

The Electrical Week

FUTURE NEWS ▶ **Watch Congressional reaction to two forthcoming power matters.** The House Interior Committee will hold a one-day hearing on July 24 on bill authorizing Pacific G&E to develop power facilities on Trinity River. Senate Commerce Committee will hold hearings July 28-30 on six bills to amend Federal Power Act, including raising FPC exemption of small hydro projects from 100 to 2,000 hp.

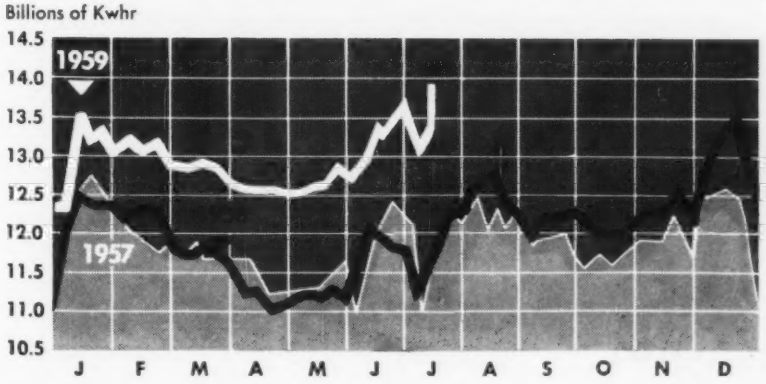
LATE NEWS ▶ **U. S. Court of Claims rules Dixon-Yates contract was valid** and awards Mississippi Valley Generating Co $1,867,545 in termination costs. Majority of court ruled that there was no conflict of interest involving Adolph Wenzell, who acted as government advisor when the contract was being set up. The government contended that Wenzell's dual role (he was associated with a Boston banking firm) violated the law and invalidated the contract. Decision is seen as vindication of Middle South Utilities and Southern Co's position. Justice Dept can now appeal the case to the Supreme Court.

Anaconda drops copper price 1½¢ to 30¢ a lb to meet cuts by competitors. Cuts are viewed as a result of imbalance of supply and demand rather than slackening of long-term demand.

Acquisitions . . . Connecticut L&P moves on lease-sale agreement of municipal system of Norwich, Conn. Voters will decide the matter in referendum Aug. 11 . . . Citizens Utilities buys Swanton, Vt., municipal and 4.1 miles of 33-kv transmission line connecting two other towns. CU also buys distribution system from Mississippi Paper Division of Standard Packaging Corp.

National Hells Canyon Assn changes its name to River Resources Assn of the Pacific Northwest. Some observers view change as tacit admission that high federal dam at Hells Canyon is a lost cause.

WEEKLY POWER OUTPUT—UP 13.9% (Week ending July 11), Kwhr 13,502,000,000



Per Cent Change From Previous Year

	June 27	July 4	July 11
Total U. S.	+16.9	+17.1	+13.9
New Eng.	+11.4	+13.6	+ 6.5
Mid. Atlan.	+16.4	+12.7	+10.6
Cent. Ind.	+21.5	+20.2	+18.3
West Cent.	+21.4	+14.6	+11.3
Southeast	+12.8	+14.9	+10.0
South Cent.	+16.4	+18.8	+19.3
Rocky Mount	+15.3	+12.8	+12.8
Pacific			
NW	+18.5	+28.0	+19.9
SW	+15.9	+18.8	+13.7

Seasonally Adjusted Index 258.5

Week Ago 270.3 Year Ago 227.8

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **The Senate has approved a TVA bond-financing bill** that possesses such mild budgetary controls that minority leader Everett Dirksen urged a veto, if and when it reached the White House **(p 80)** . . . GE's reduction of large turbine-generator prices brought indications that Westinghouse and Allis-Chalmers would follow suit, but that the industry wasn't in for a series of price cuttings **(p 81)** . . . FPC last week dealt a damaging blow to the ECAP program by ruling evidence on a disputed ad series wasn't admissable **(p 83).**

MEETING REPORT ▶ AIEE SUMMER GENERAL MEETING **Big engineering news this week is AIEE Summer General Meeting,** held in Seattle, June 21-26. Here are a few of its highlights:

- **Coveted gold Lamme Medal went to two winners (p 86).**
- **J. H. Foote takes over as 1959-60 AIEE president (p 86).**
- **A-plants begun under 1954 Atomic Energy Act** total 1,000 eMw. High capital costs have been their chief difficulty; savings will have to come through optimizing designs **(p 87).**
- **Manufacturer-utility team uses computer to forecast growth** of load and to plan system expansion **(p 88).**

ENGINEERING ▶ **Photos show source of noise on EHV line (p 90)** . . . Computer solves relay problems **(p 94).**

Politics and Public Power

BACKGROUND FOR A DECISION

It is a fact of political life that action taken in a given issue often has little or nothing to do with the merits of that issue. An example of this may be in the offing—in what President Eisenhower decides to do about the TVA bond-financing bill that will eventually come to him from the House-Senate conference committee now working on it. (See page 80.)

While the bill itself—or rather the two bills from which it will spring—seem to satisfy, paradoxically, most of the demands of both the proponents and opponents of the whole concept of TVA self financing, it does omit some checks in an area which the President is known to regard as important, namely budgetary controls.

Just how important Eisenhower regards these controls remains to be seen, but it is certain that he and his advisors will weigh carefully his actions in the light of another —perhaps his favorite—theme: the need to check inflation.

There is an increasing amount of evidence that his admonitions about inflation are beginning to take hold in the public mind. A number of recent developments—the steel industry labor negotiations, the 1958 budget deficit, and others—have added impetus to what the President has been saying.

It is just possible that he will use the TVA bond bill to keep this "check inflation" ball rolling. He can do this by vetoing it on the ground that its lack of control by the Budget Bureau tends to make it inflationary. He could easily support his action on the basis that the issuance of TVA bonds is, after all, only another form of public borrowing,

PROCUREMENT & PRODUCTS ▶ **Summer cuts in business inventory may not be so dramatic as expected** . . . Copper fabricators reduce buying in anticipation of drop in prices . . . At the same time, some analysts see a hike in aluminum prices, following a new labor contract **(p 110).**

MANUFACTURERS ▶ **Pennsylvania Transformer opens secondary substation facility** . . . Federal Pacific ships first circuit breaker from Santa Clara, Calif., plant . . . Line Material expands research facilities **(p 118).**

NEW EQUIPMENT ▶ **New tensioner comes in two parts** . . . 13.2-kv transformer extends range of applications of GE recording volt-ammeters . . . Bail clamps feature a bail positioned at right angles **(p 128).**

MANAGEMENT ▶ **How does Wall Street compare your company's stock with others?** How you take liberalized depreciation and accelerated amortization has a growing influence. For a view from one brokerage house, turn to **p 157** . . . Atomics International's Chauncey Starr attacks the "mythology" of nuclear power development **(p 160).**

SELLING ▶ **Street lighting performance is equipment supplier's responsibility** in Southwestern Public Service Co area **(p 165).**

and tends to push up the inflationary spiral.

A veto would sound the death knell for the bill. The House version was passed by only 245-170, far short of the required two-thirds majority needed to override the veto. The vote in the Senate was by voice, and no count was taken.

But Eisenhower probably will not make his veto decision on these considerations alone, for there is another side to the story . . .

The bill, having had a series of amendments tacked on to it in both Houses, is a reasonable one. (Even some utilitymen admit privately that they like it.) It reflects the moderating influence of Senate Majority Leader Lyndon Johnson and House Speaker Sam Rayburn, an influence exercised with no little difficulty against that of their more liberal colleagues.

An Eisenhower veto, therefore, could have two deleterious effects from the White House point of view:

(1) It could weaken this Johnson-Rayburn influence in favor of the liberals, a result that the President surely cannot regard as favorable; and

(2) It could help lend credence to recent Democratic charges that the Administration is veto-happy and obstructionist. And this is a label the Republicans—eyeing next year's elections—will wish to avoid.

The circumstances, then, seem to point to further compromise, especially on the point of Budget Bureau control of TVA's bond issuing operations. This course of action would be in the interest of both parties.

But whatever the result, you can be sure that the merits of the TVA bond bill will constitute only part of the reason for its having come about.

NUCLEAR NOTES

Production of radioisotopes in central-station power reactors seems to be a real part of the AEC's plans for promoting these elements. In time, utility power reactor operators could find themselves very much involved in this by-product activity

American industry's interest in radioisotope use has not been as great as the AEC had hoped. So the Commission, to churn up flagging interest, is conducting a multi-faceted program. Typical is the sponsoring of symposia on industrial uses of radioisotopes, like the one to be held in Buffalo August 20-21.

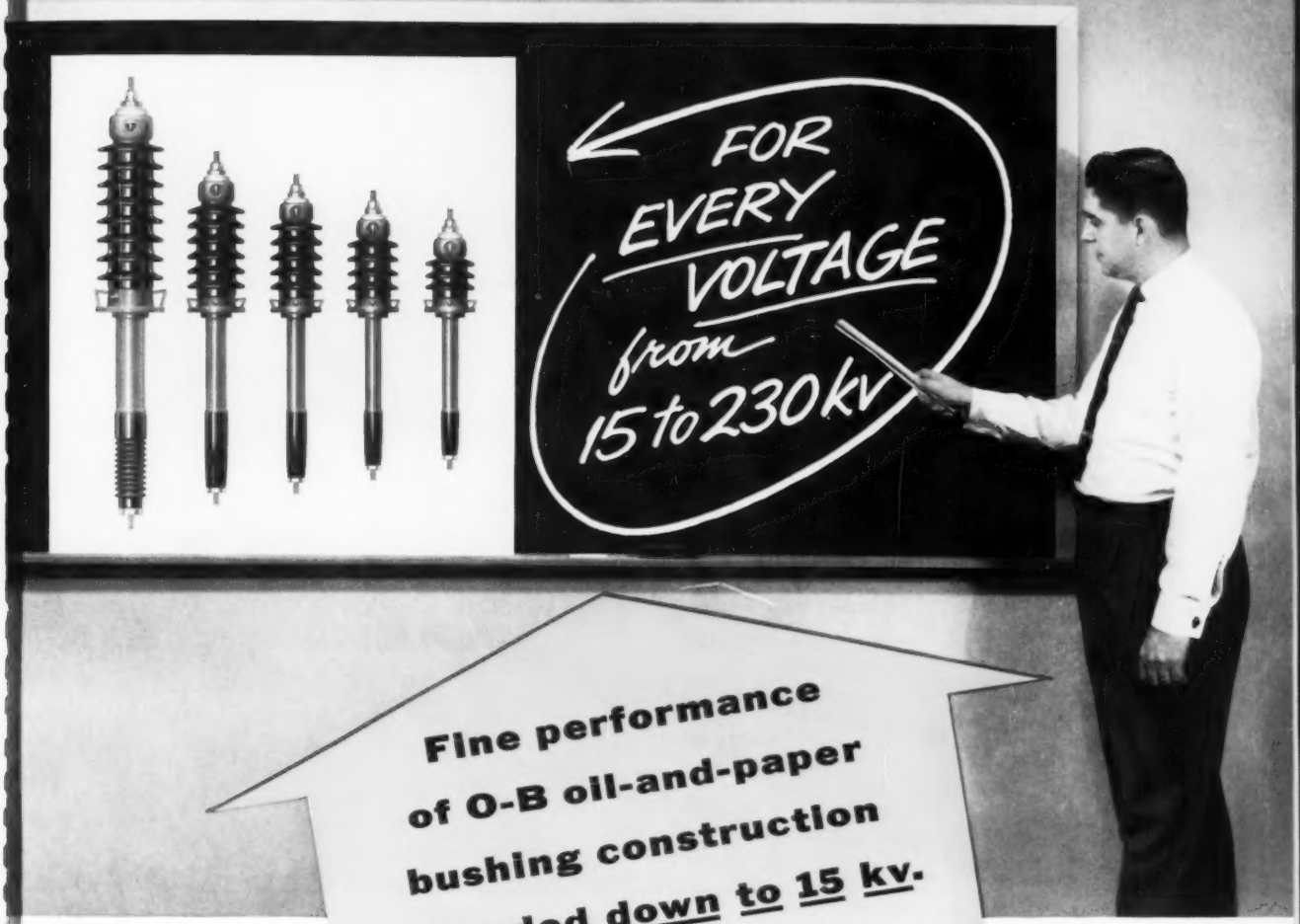
Reduction of isotope cost is a part of this program. So there are efforts to explore feasibility of using power reactor radiation to produce radioisotopes. For example, AEC recently awarded a $33,200 contract to Booz-Allen Applied Research, Inc., to evaluate the potential of boiling water, sodium graphite and pressurized water reactors to produce phosphorus 32, tritium, carbon 14, cobalt 60, potassium 42 and sodium 24.

Success of these programs could place reactor-operating utilities squarely in the isotope business. Presumably the AEC, where it contributed to research and development of a particular reactor, would continue its aggressive policy of radioisotope promotion by "encouraging" the reactor operator to produce these elements.

The new field of nuclear insurance took another step toward maturity with announcement by the Atomic Industrial Forum of the availability of a three-unit "bookshelf" in this area. "Financial Protection against Atomic Hazards" ($2); "Nuclear Liability Insurance and Indemnity" ($1); and "International Problems of Financial Protection against Nuclear Risk" ($6) are the three paperbounds obtainable from AIF, 3 E. 54th St, N.Y. 22. The complete set can be had for $7.50.

Britain's fifth—and largest—nuclear power station has just swung into construction. The 500-eMw plant will be located in a famous, if unpronouncable, Welsh beauty spot: Trawsfynydd. The architects were careful to blend external appearance of the station with the beautiful countryside. According to reports, their concern extended to designing the reactors low enough to avoid breaking the skyline.

Now–for any voltage



Fine performance of O-B oil-and-paper bushing construction extended down to 15 kv.

You can have O-B Class GK (oil-and-paper) bushing construction, today, for any operating voltage between 15 and 230 kv. The best bushing we have made in nearly 50 successful years has now been extended into the voltage range below 69 kv.

High interchangeability -- exceptional mechanical strength in circuit breaker service -- many exclusive manufacturing safeguards -- are only a few of the extra values this bushing has to offer.

O-B's new "Table 2"* bushings are yours just for the asking. They can be supplied on any new station apparatus. Simply express your preference for O-B, and you will have a share in the industry's finest performance record.

*See Table 2, ASA Bushing Standard C76.1a — 1958.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4930-H1

Ingenious pothead design

The electrical stress cone of a high voltage pothead -- one of its most vital components - - has depended, in the past, on somewhat "primitive" methods. In O-B's new capacitor graded pothead, this important part has at last yielded to adroit design.

Permanently attached to the paper buildup is a narrow foil strip, set at a slight angle. Wrapping of this buildup generates a stress cone having a smoothly-formed helical shape of predetermined logarithmic conformation. Furthermore, this highly refined version of a stress cone is produced under completely controlled conditions, as a by-product of installing the factory-made buildup.

Many other parts show equally ingenious design. These new O-B potheads are applicable to any type of cable, presently in the range of 115 to 230 kv.

If you contemplate the use of underground cable, be sure to investigate this new O-B terminal equipment. Discuss it with your O-B representative, or write us direct.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4930-H2

"The most" arrester

Seems almost impossible -- it *has been* 'til now -- that a Distribution Class lightning arrester will exceed by almost three times the ASA Standard low-current, long-duration durability test prescribed for the heavy duty Station Class. Thorex Type DV routinely withstands 20 applications, in 6½ minutes (one-tenth the required time), of over 400 amperes, for 2,000 microseconds.*

Does this have any more than "conversational" value? In districts of 30 annual storm days, for example, reliable statistics record an average of one lightning stroke per year, per mile of line. Distribution circuits usually do not have the protection of an overhead shield wire.

Every lightning stroke contains some component of low-current, long-duration wave form -- at times, very severe.

Maximum service continuity of most Distribution circuits logically calls for lightning arresters of high durability characteristics. These are found, today, only in the Thorex Dynagap Type DV. This "extra" is yours without extra cost. Specify these arresters on new distribution transformers, and install them on new poletop construction.

* Station Class: 150 amperes, 2,000 microseconds, applied 20 times in a total of 75 minutes.

OHIO BRASS COMPANY, MANSFIELD, OHIO

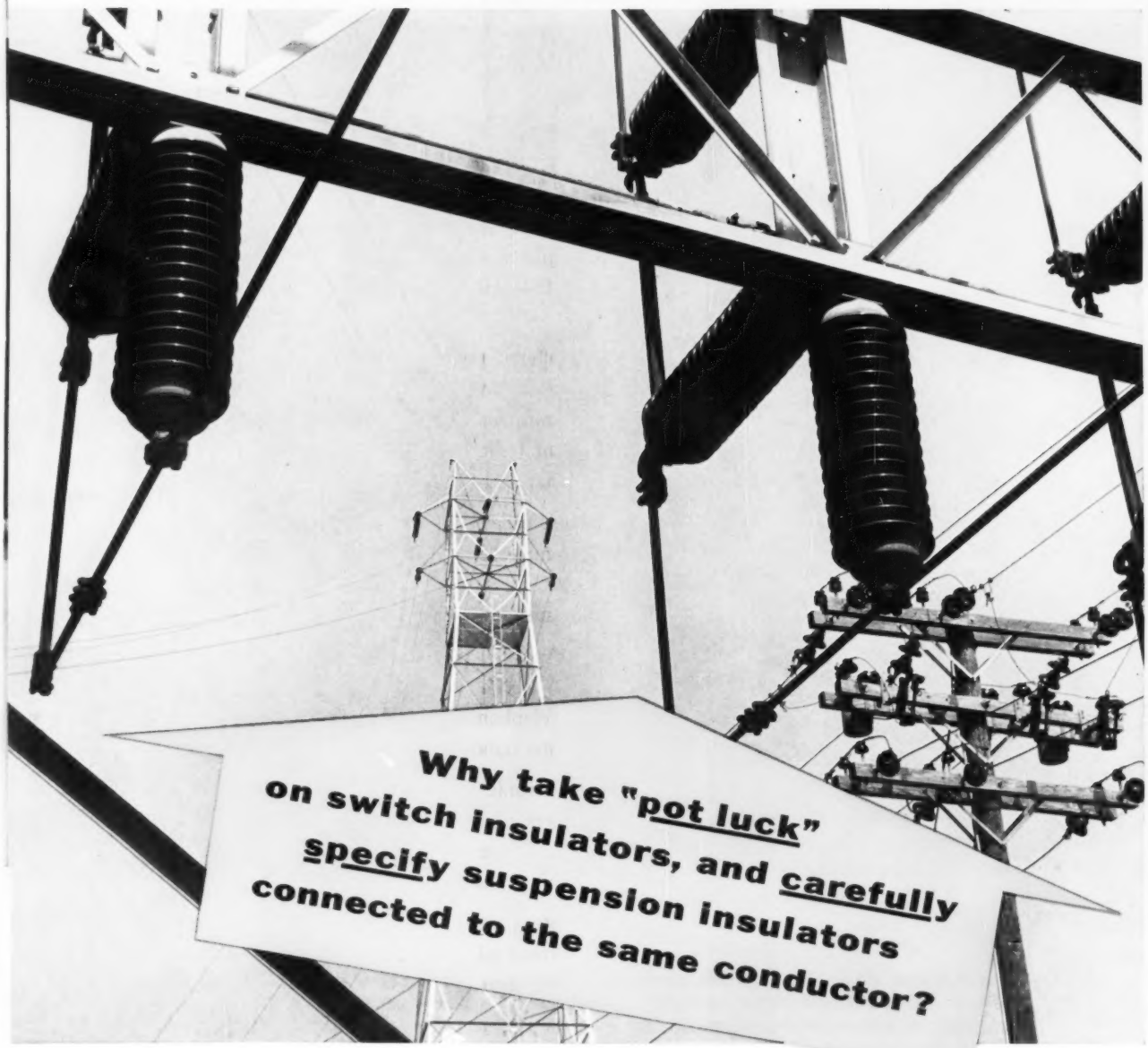
Ohio Brass

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

4930-H3

What's the difference?



Careful thought was given the selection of suspension insulators for this river crossing. Why should insulators only a few hundred feet away - - connected to the same set of conductors - - equally capable of making trouble - - be bought on the basis of "pot luck."

This is what happens when switches are purchased without any expressed preference for make of insulation. Switchgear manufacturers are willing and able to furnish any insulator of your choice. It costs you no more in dollars or trouble. The service is yours for the asking.

Go into your own performance records, gathered on your own terms, and you will probably find the lowest rate of depreciation and the fewest cases of trouble with O-B. It's easy to put O-B insulation on any switch you buy. Just name it and you can have it!

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

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BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4930-H4

"PACKAGING" MICROWAVES FOR MOUNTAIN TOPS

"TJ" radio-relay station at Black Mesa, Arizona

In Arizona, the telephone company faced a problem. How could it supply more telephone service between Phoenix and Flagstaff—through 135 miles of difficult mountain territory?

Radio offered the economical answer: a new microwave radio-relay system recently created at Bell Telephone Laboratories. Operating at 11,000 megacycles, it was just right for the distance, and the number of conversations that had to be carried.

But first other problems had to be solved: how to house the complex electronic equipment; how to assemble and test it at hard-to-reach relay stations way up in the mountains; and how to do it economically.

On-the-spot telephone company engineers had some ideas. They worked them out with engineers at the American Telephone and Telegraph Company and at Bell Telephone Laboratories. The result: a packaged unit.

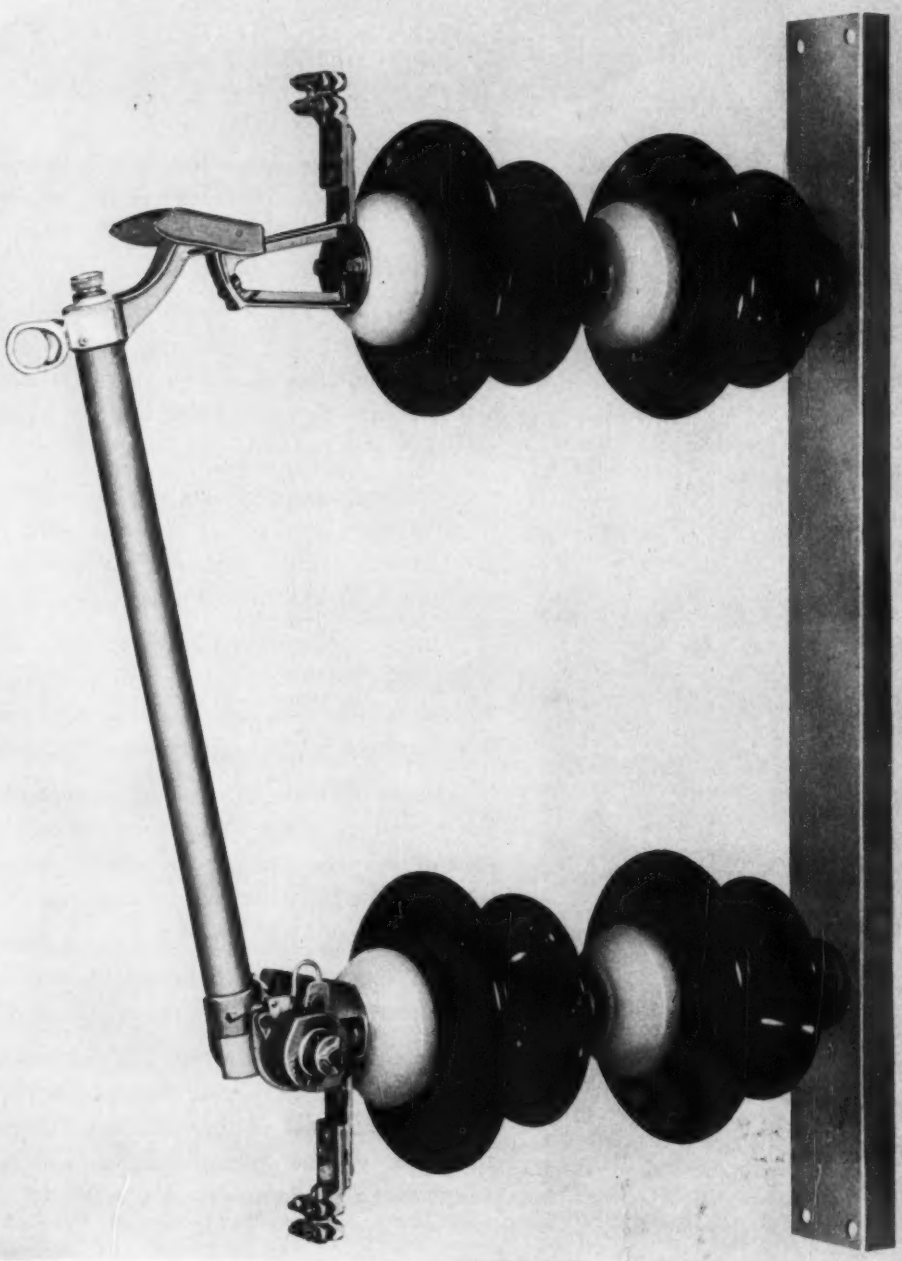
The electronic equipment was assembled in trailer-like containers at convenient locations and thoroughly checked out. The complete units were then trucked up the mountains and lifted into position.

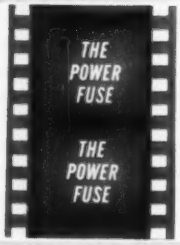
The system, now operating, keeps a watch on itself. When equipment falters, a relay station switches in standby equipment, then calls for help over its own beam.

The new Phoenix-Flagstaff link illustrates again how Bell System engineers work together to improve telephone service. Back of their efforts is the constant development of new communications systems at Bell Telephone Laboratories.

BELL TELEPHONE LABORATORIES *World center of communications research and development*

An Economical New Family of P





New full color sound movie on power fuses now available to any interested activity

Here is the dramatic story of the Power Fuse told in 25 minutes, including animated illustrations, actual field tests, and engineering data. Factual, up-to-date, informative. For a private showing, contact your Southern States representative or write direct to the company. (16 mm, color, sound.)

Power Fuses by Southern States

- LOW INITIAL COST—LOW RE-FUSING COST
- INTERCHANGEABLE FUSE HOLDERS
- WIDEST SELECTION OF RATINGS
- SIMPLIFIED CONSTRUCTION

Engineers charged with the dual responsibility of adequate system protection at minimum cost will welcome this new family of Southern States Power Fuses—the greatest development in years!

The simplified design and construction of these powerful, reliable fuses result in immediate savings on initial costs, when compared with most other types.

Re-fusing in the field results in remarkable savings: For example, at 69 kv a comparative cost for re-fusing a 3-phase installation shows a price differential ranging as high as $422.00. Higher voltages reflect even greater savings.

When system demands increase, and higher ratings are needed, it is a simple matter to change fuse holders—using existing mountings—and thus reap additional savings.

The costly practice of applying a fuse with excessive interrupting capacity is no longer necessary. The widest possible selection of fuses in this new Southern States family permits fusing to meet exact requirements. Substantial savings, without sacrifice, can be made here!

With interrupting ratings approaching 3½ million kva at 161 kv, it will pay everyone concerned with power fuses to investigate this new family of power fuses. Contact your Southern States representative, or write direct for Technical Bulletin 59PF.

COMPLETE FUSE KITS AVAILABLE

Clearly marked fuse kits are available at low cost for re-fusing Southern States Power Fuses *in the field*, easily and quickly. All components are sealed in moisture-free polyethylene bags. Kits are available in four speed ratios: PF (slow speed), PM (medium speed), PX (fast speed) and EEI-NEMA Type PE. Time-current characteristic curves are available for all fuses.

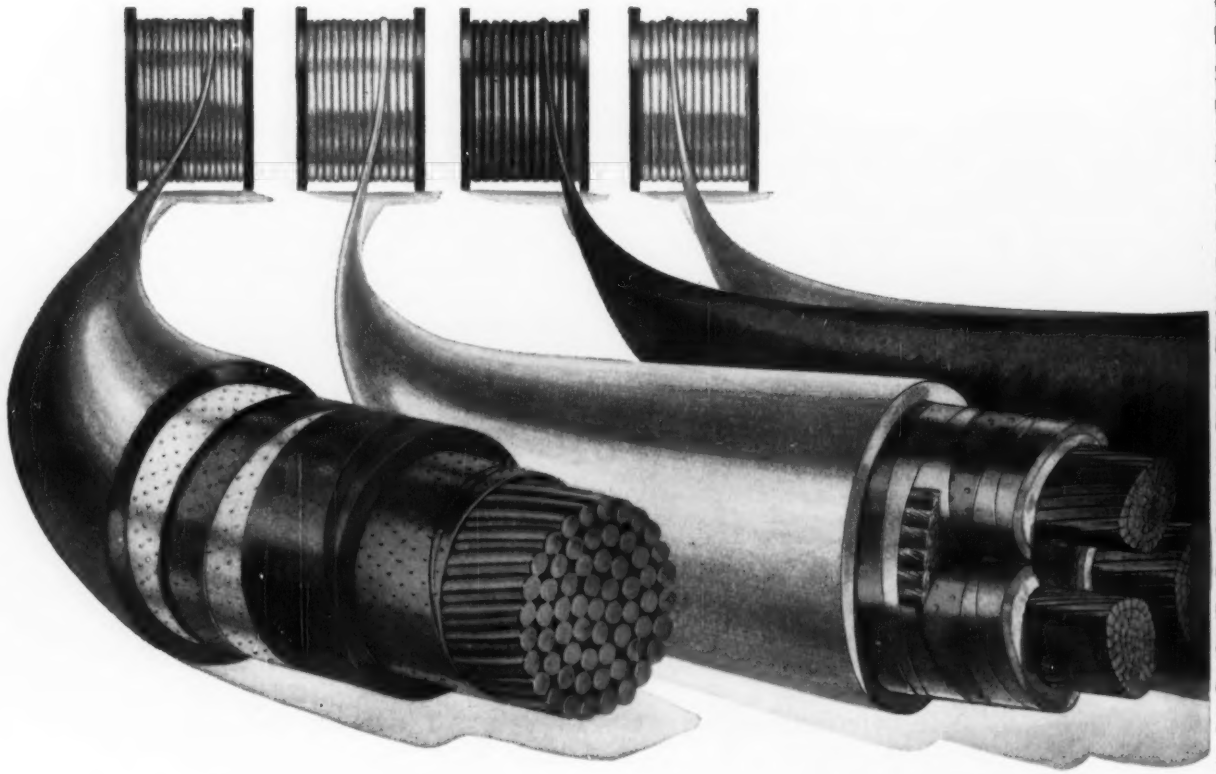
PIONEERS IN POWER FUSES SINCE 1924

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

FOR THE MOST EFFICIENT
POWER DISTRIBUTION . . . SPECIFY

PAPER-INSULATED CABLES BY PHELPS



Single conductor, 1 KV and up

Three-conductor, 1 KV and up

DODGE!

Phelps Dodge paper-insulated power cables have a *demonstrated record* of long life in a great variety of designs for all types of applications—underground duct, direct burial, submarine and aerial.

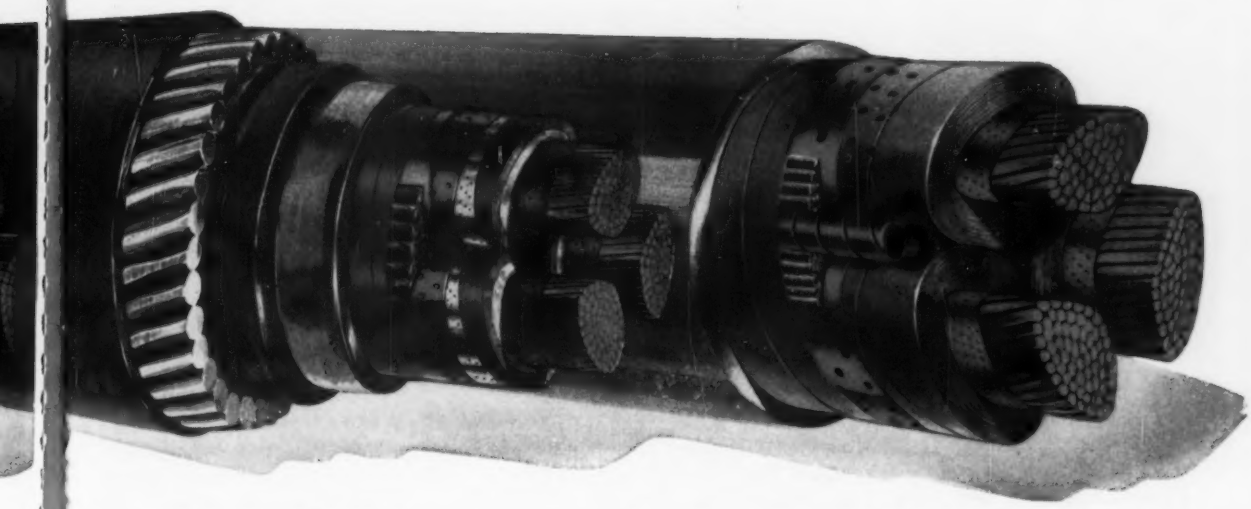
Paper-insulated cables have these important inherent characteristics that improve operating performance and lengthen service life:

- Extra high 60-cycle and impulse strength to withstand switching and lightning surges.
- Ability to handle large blocks of power in single cables of minimum dimensions.
- Positive protection against all contaminations, due to being hermetically sealed in an extruded metallic sheath.

Paper-insulated cables can be supplied with either lead or aluminum sheaths.

Phelps Dodge offers the widest range of high voltage cables to the electrical industry.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 PARK AVENUE, NEW YORK 22, NEW YORK



Submarine, 1 KV and up

Low-Pressure gas-filled, 8 KV and up

the **story** of Pennsylvania's NEW Pole Star Regulator

If you think this is the sort of "partnership" that can produce nothing but the best, you are absolutely right. The new Pole Star Regulator combines mechanical and electrical ruggedness with the sensitivity and versatility that are needed for effective, economical regulation of voltage.

Station-type Pole Star Regulator

My name's Casey ... Jerry Casey.

I'm a salesman. For several months I've been talking with utility people in many sections of the country about Pennsylvania's new Pole Star Regulator.

The other day I was telling our advertising manager about the enthusiasm with which the PSR is being received. Next thing I know, he's shaking my hand and saying, "Congratulations!"

"For what?" I ask.

"For being selected to write our next regulator ad," he says. "Just jot down the facts, that's all. Write them as you speak them."

OK, so I'm a fall guy. But I just can't pass up *any* opportunity to tell the story of the new Pole Star Regulator.

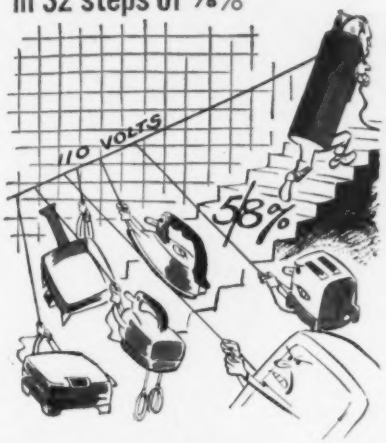
A combination that can't be beat

Now—for the first time—two of Pennsylvania Transformer's most outstanding developments have been joined in a single, incomparable product. They are—the famous Pole Star distribution transformer . . . and . . . Pennsylvania's performance-proved load tap changer.

For pole-top, platform and station installations

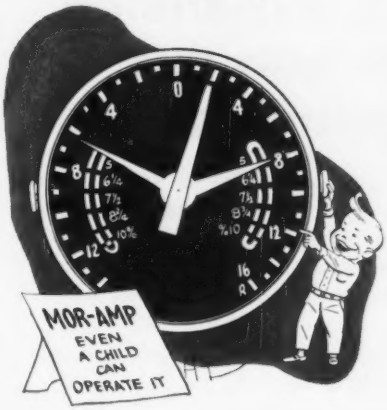
But don't think for a moment that the new Pole Star Regulator is available in just a few "introductory" sizes. The fact is, a full range of distribution sizes and capacities . . . 27 different ratings, to be exact . . . is now in production. Most regulators are equipped with both hanger brackets for pole-top installation, and hold-down lugs for mounting on platforms or cement pads. The larger, station-type units have the sturdy Pole Star base.

Regulates automatically in 32 steps of 5/8%



How does the Pole Star Regulator function to maintain voltage at a constant level? Voltage is raised or lowered, according to the load at any given time, in what Pennsylvania Transformer studies indicate is the most desirable pattern: that is, in 32 steps of 5/8%. An automatic tap changer adjusts the voltage to this degree whenever it remains outside a narrow band of plus or minus one volt for more than ten seconds—or whenever fluctuating voltage averages more time outside the operating band width than within it. (Both the time delay and the operating band width may be varied to suit local conditions.) The normal operating range of the Pole Star Regulator is plus or minus 10%, with 16 tap positions above normal and 16 below.

Mor-Amp feature gives 60% extra capacity



You can bet on those Pole Star designers, however, to make allowance for unusual conditions—and that's just what they have done with the Mor-Amp feature. Even a child could operate the Mor-Amp control, which reduces the range over which the regulator functions in order to provide additional capacity. As much as 60% extra capacity—up to 668 amperes—can be obtained this way.

You might even say the Pole Star Regulator has telescopic vision—or "telepathic brain" might be a better way to put it. By means of a line drop compensator, adjustments are made for any low voltage conditions that exist at points far removed from the regulator, even though voltage at the regulator might be satisfactory.

A new tap changer backed by 20 years' experience

As for the real heart of the regulator—the tap changer—you get the full advantage of Pennsylvania's 20 years of actual manufacturing experience in the highly technical field of load tap changing. I just wish all of you could see the direct-drive mechanism in action! Used on all regulators rated 13800 and 14400 volts or with current ratings from 201 through 668 amperes, it measures up, in all respects, to Pennsylvania's well-known power transformer load tap changers! It has the same operating smoothness and long-lasting ruggedness—in fact, its design and construction features are basically the same as those that have stood the test of time in power transformer applications.

The smaller, spring-driven tap changer—used on regulators rated 7620 volts and below and with current ratings less than 201 amperes—also is a honey. Both tap changers are guaranteed to help your customers to live better electrically.

Quiets customer complaints about voltage

But why not see for yourself how the new Pole Star Regulator provides efficient, economical regulation of voltage . . . maintains consistently satisfactory voltage for all purposes . . . and quiets customer complaints regarding voltage to a barely audible whisper? Your order will get prompt attention at Pennsylvania Transformer, whether your needs are for a single unit or for several dozen.

Or, if you would like more information about the Pole Star Regulator, please drop me a line at the address shown below, or telephone Sherwood 5-9100. If I have not already visited your company, perhaps you would like to arrange a demonstration for some of your engineering and purchasing personnel.

Sincerely,
Jerry Casey

Pennsylvania Transformer Division
McGraw-Edison Company
Canonsburg, Pa. Greater Pittsburgh District

You get over 60% expansion into solid earth with this CHANCE 8-Way Expanding Anchor

It's a fact! Sixty three per cent of the Chance 88135 Anchor, shown above in reduced size, expands into solid, undisturbed earth. All Chance 8-Ways give similar expansion—develop all-around holding power. The eight rib-reinforced blades expand to form a square, with no wasted space between blades. Holding power is distributed over a wide area.

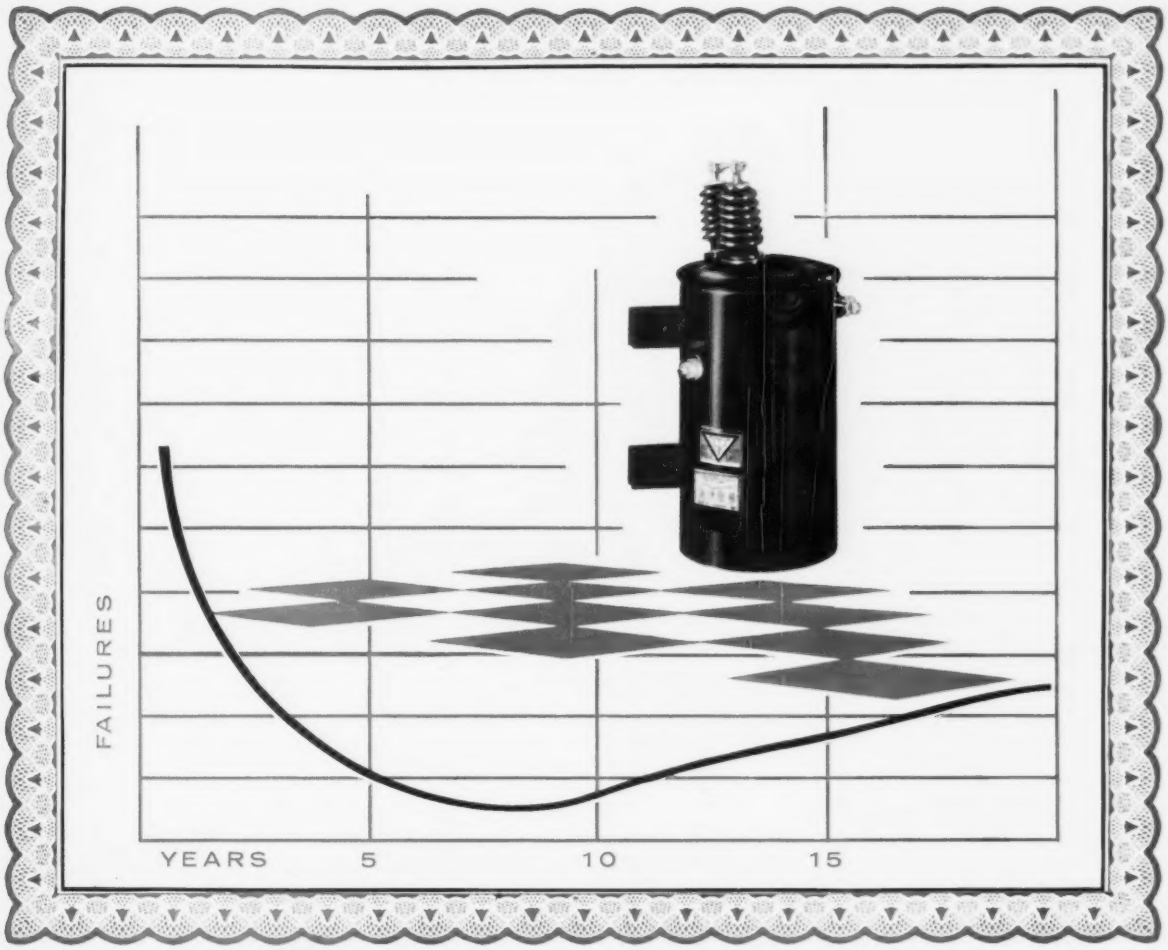
Chance 8-Ways are now packed in extra high-strength, color-coded cartons for better storage and handling.

Build lines to STAY with the CHANCE 8-WAY

A. B. CHANCE COMPANY

CENTRALIA, MISSOURI A. B. Chance Co. of Canada, Ltd., Toronto

CA59-5



GUARANTEED

for 5 years — further proof of the exceptional quality built into every RT&E Transformer to save you money. The wisdom of this guarantee is borne out by the graph above. This typical mortality curve was developed from actual failure rates of one leading utility and covers all makes of transformers. It shows clearly that most transformer failures due to workmanship and materials occur during the first 5 years of use, the critical period covered by the RT&E guarantee.

In addition to this 5 year guarantee against defective materials and workmanship, RT&E also guarantees all fully protected transformers unconditionally for one full year.

RT&E CORPORATION
WAUKESHA, WISCONSIN
PORTLAND, OREGON

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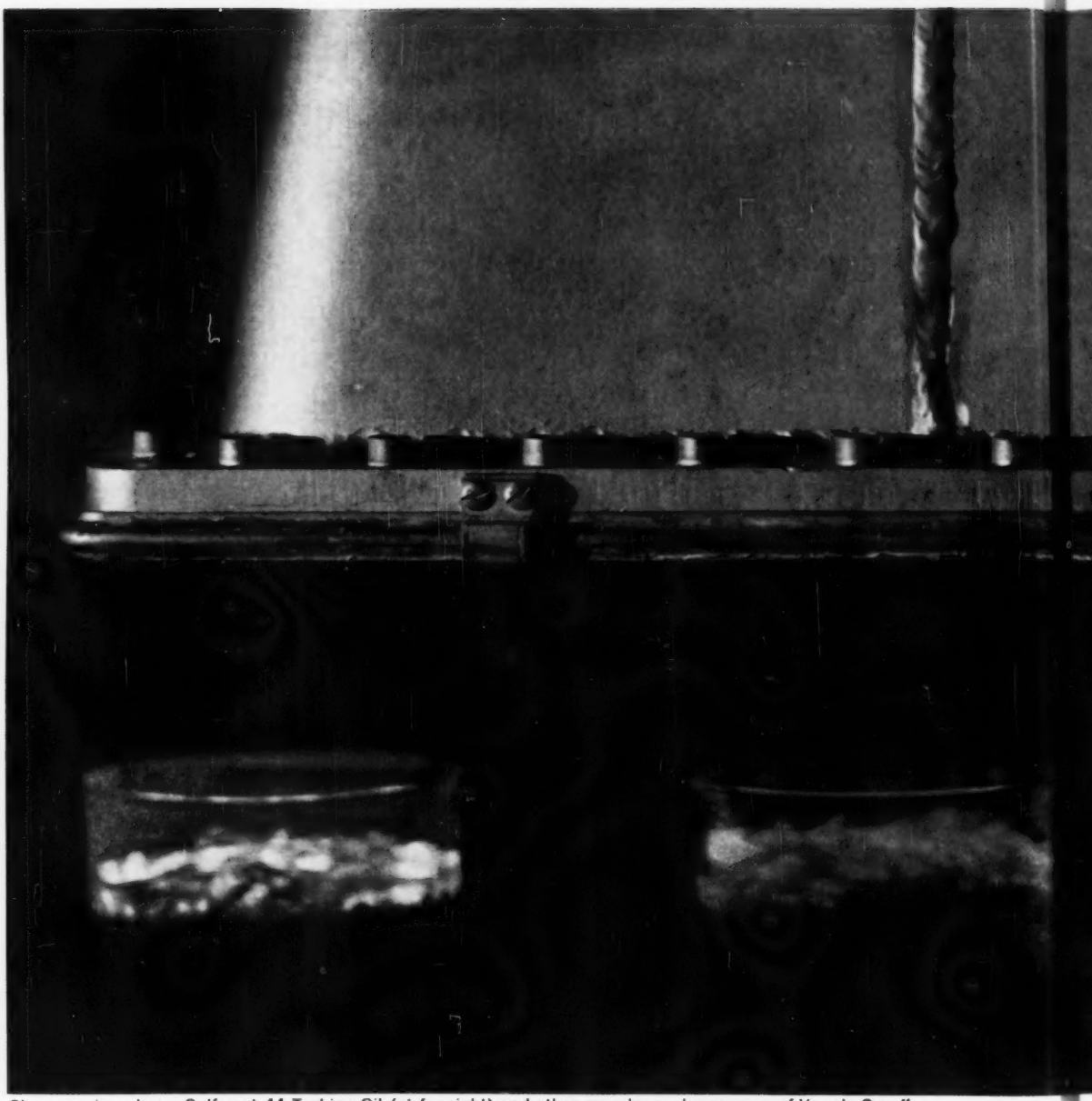


Close-up view shows Gulfcrest 44 Turbine Oil (at far right) and other samples under scanner of Van de Graaff atom smasher. Atomic bombardment causes unique color reactions. Unusual photo was taken by Gulf Research photographer inside target room during radiation, with lead-shielded camera protected by 8-inch water barrier.

Gulf research pins down radiation

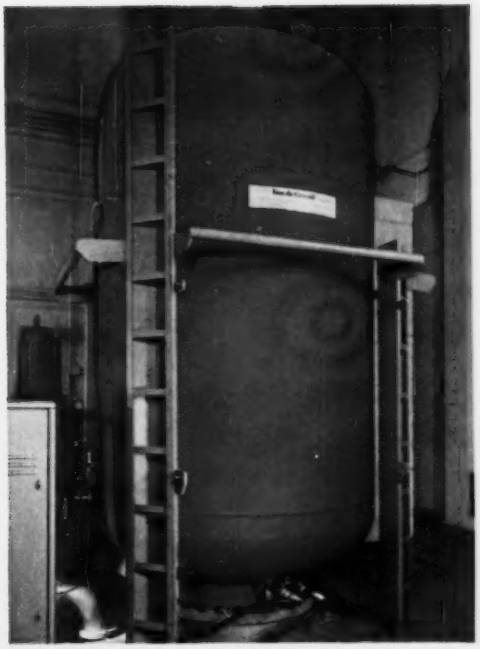
With more and more nuclear power plants going into operation . . . on land, on the sea and under the sea . . . the effect of nuclear radiation on lubricating oils is of increasing importance. How much radiation can lubricating oils take?

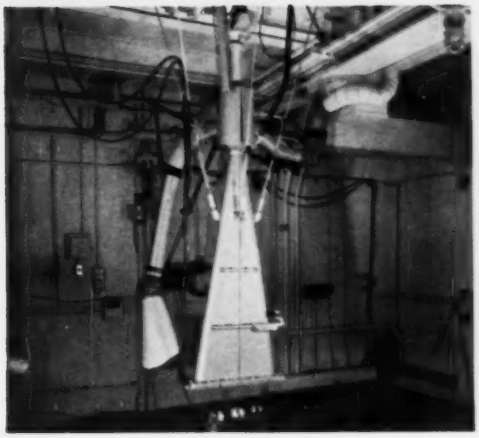
To find the answer, Gulf researchers bombarded samples of turbine oil with electrons in a 3,000,000 volt atom smasher. By analyzing changes in the irradiated oil, they established the radiation limits below which commercially available oils will function properly.

The actual limit is about 45 million "rads"—a dosage of radiation beyond which the turbine oil begins to break down. These findings are extremely important to the power industry. And if the need arises for specific oil products to withstand more radiation, Gulf scientists are prepared to help industry solve this problem.

Meanwhile, Gulfcrest—the world's finest oil for turbine lubrication—continues to serve industry in both conventional and atomic power plants, including America's largest, the Shippingport Station of Duquesne Light Company in Pennsylvania.

Over 75% of the nuclear electric power now generated





Two-story high 3,000,000-volt Van de Graaff atom smasher bombards samples with nuclear radiation at Gulf Research Center. Red generating unit propels electrons down tube to target room below, where samples are irradiated.

orimits of lubricating oils

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in the United States is produced by turbine-generators lubricated with Gulfcrest. And, in Gulf's marketing area, more power is generated by central station steam turbines lubricated with Gulfcrest than with any other turbine oil.

If your company uses petroleum products in any operation—for plant equipment, for company cars and trucks, or for any other purpose—see how Gulf makes things run better. Call your Gulf office . . . or for further information on Gulfcrest oil or Gulf Research activities write to Gulf Research Center, Pittsburgh 30, Pa.

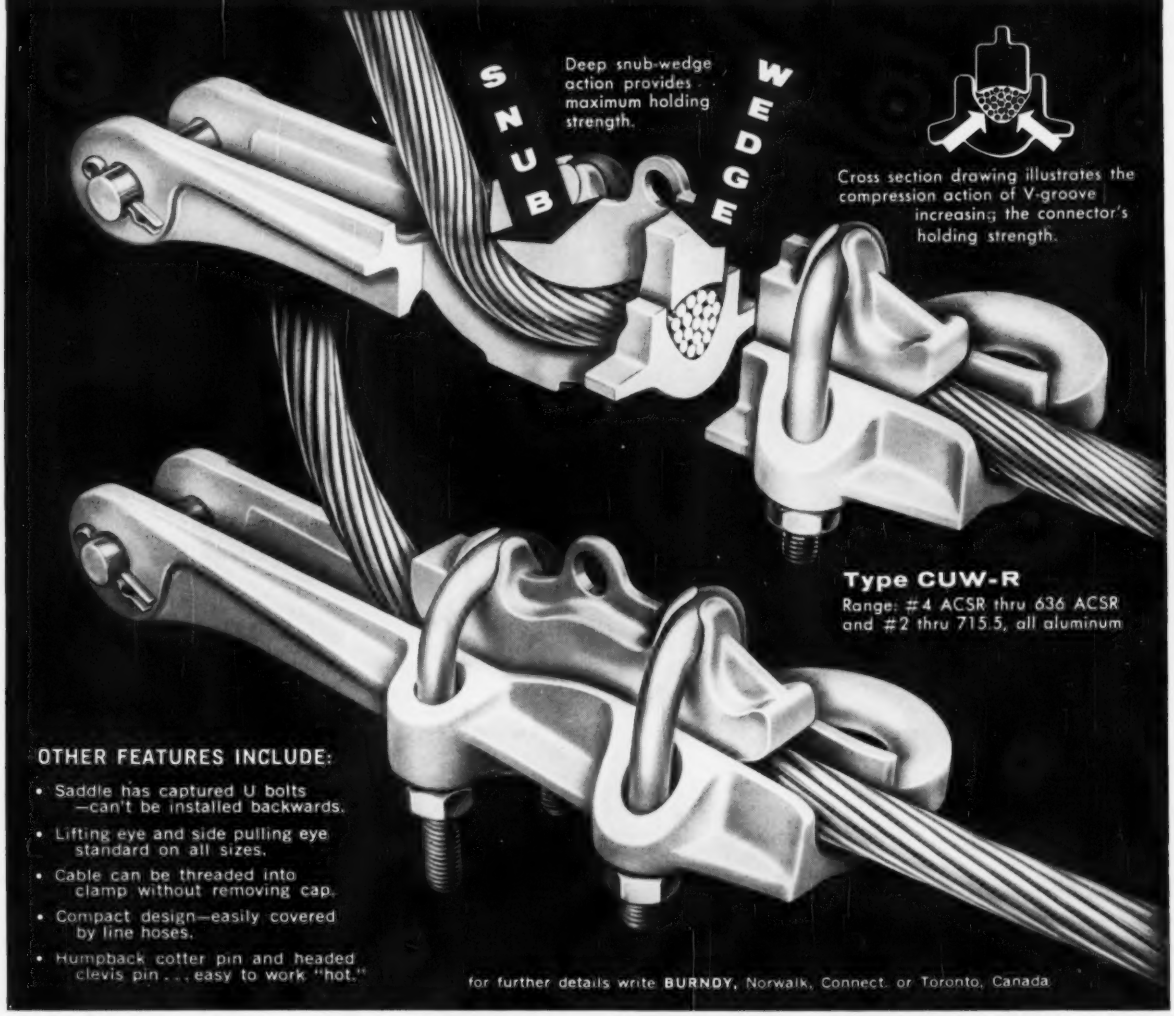
GULF OIL CORPORATION
Pittsburgh 30, Pa.

GULF

GULF MAKES THINGS RUN BETTER!

get the inside story on this aluminum

DOUBLE ACTION
LOW COST
DEAD END CLAMP



Deep snub-wedge action provides maximum holding strength.

Cross section drawing illustrates the compression action of V-groove increasing the connector's holding strength.

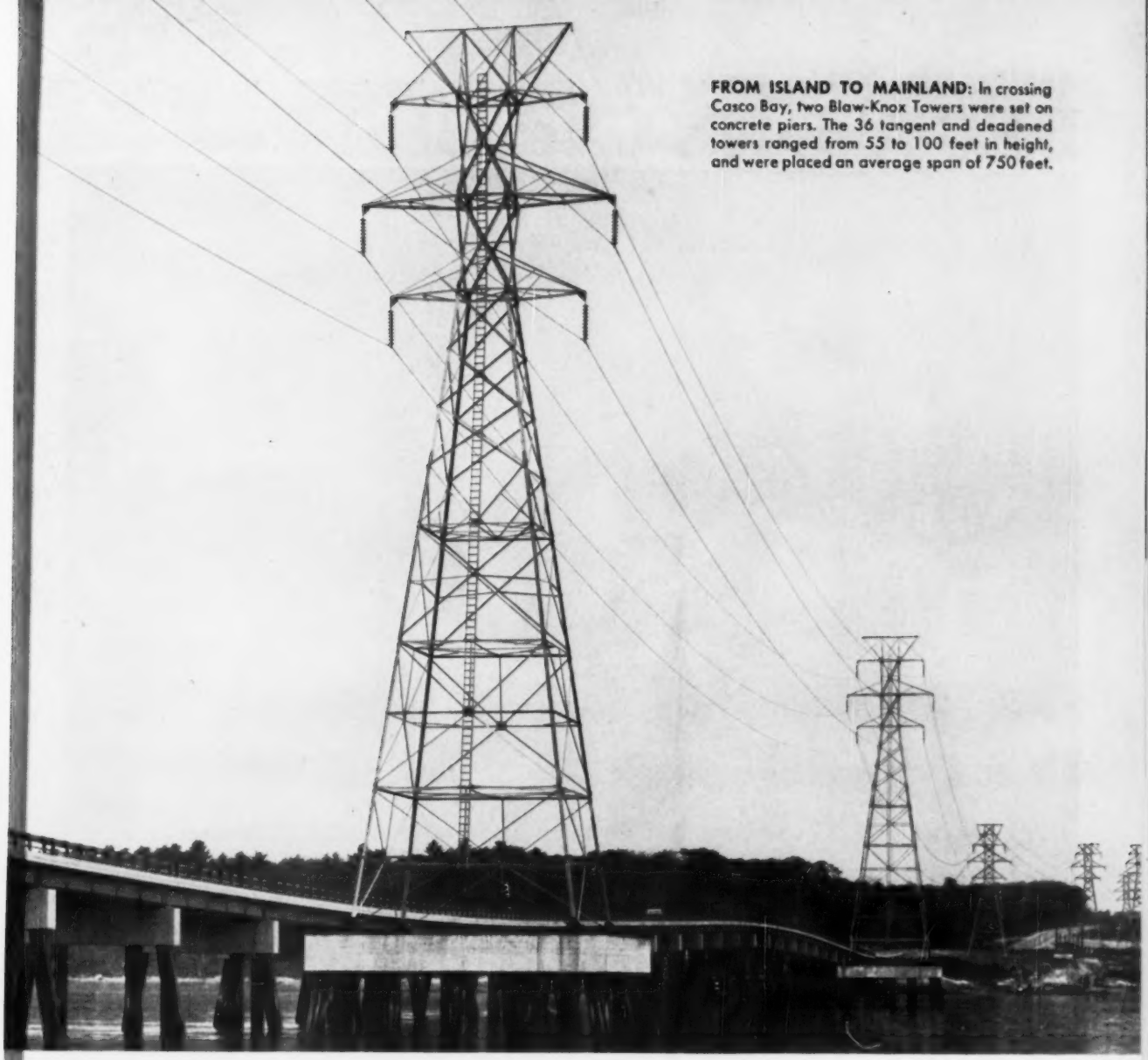
Type CUW-R
Range: #4 ACSR thru 636 ACSR and #2 thru 715.5, all aluminum

OTHER FEATURES INCLUDE:

- Saddle has captured U bolts —can't be installed backwards.
- Lifting eye and side pulling eye standard on all sizes.
- Cable can be threaded into clamp without removing cap.
- Compact design—easily covered by line hoses.
- Humpback cotter pin and headed clevis pin . . . easy to work "hot."

for further details write **BURNDY**, Norwalk, Connect. or Toronto, Canada

BURNDY



FROM ISLAND TO MAINLAND: In crossing Casco Bay, two Blaw-Knox Towers were set on concrete piers. The 36 tangent and deadened towers ranged from 55 to 100 feet in height, and were placed an average span of 750 feet.

Central Maine chooses Blaw-Knox Towers to carry lines from new Cousins Island Plant

The new Yarmouth Steam Plant—the newest and potentially the largest in Maine—is the latest development by Central Maine Power Company to meet the increased needs of its growing number of customers. The new showcase plant will use two 44,000 kw turbine-generators along with the latest and largest transformers and condensers in the state.

To carry the 115,000 volt lines from Cousins Island to the Moshers substation in Gorham, Blaw-Knox designed and fabricated 36 steel transmission towers. Working with Central Maine's engineers Blaw-Knox was able to bring over 40 years of transmission tower experience to the job. Basic concepts evolved from this extensive experience are used to build towers that are superior in strength, simpler to erect, easier to modify.

See how this background can pay off in meeting your own tower requirements. For details, send for Folder 2509 and tell us your needs. We'll gladly give you our recommendations and a quotation.

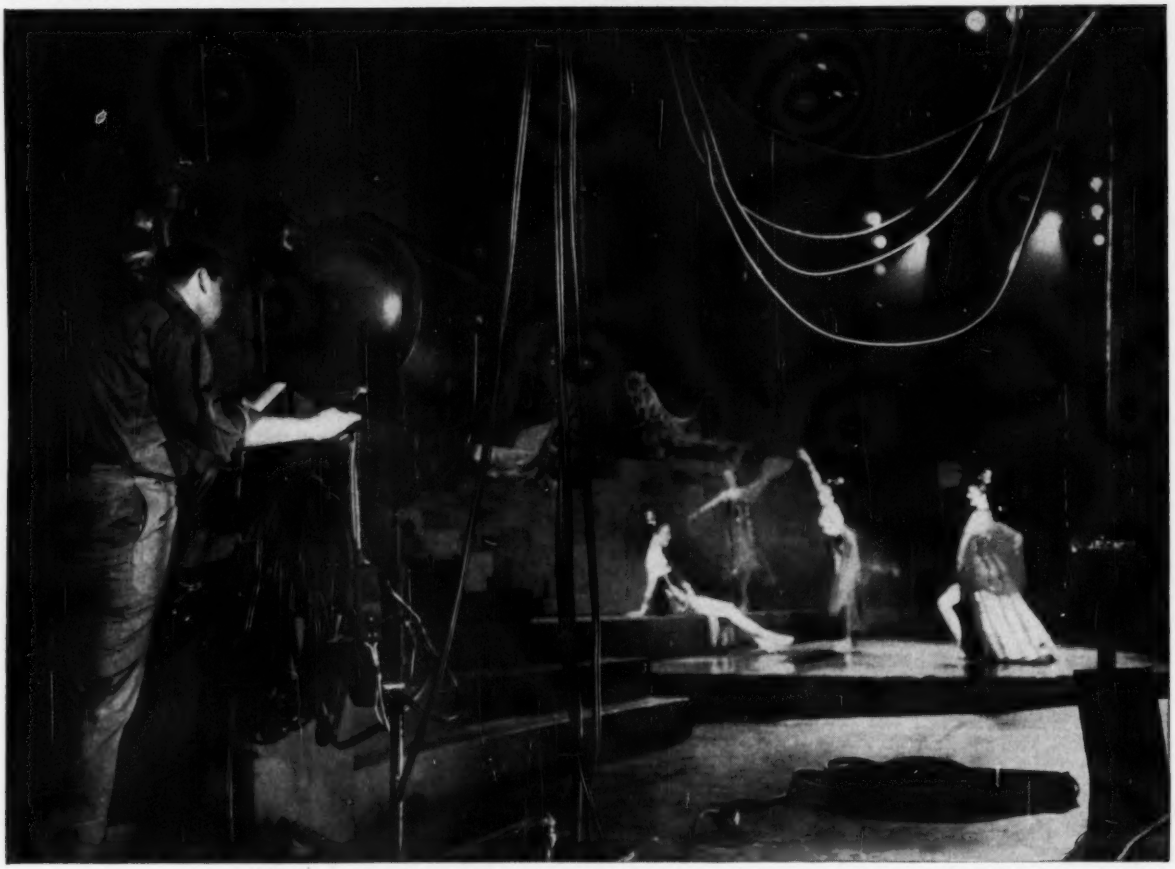
Transmission Towers—Steel Transmission towers, custom-built for each installation . . . multi-circuit and other special structures . . . and antenna towers, guyed and self-supporting types for AM • FM • microwave • communications • radar • parabolic antennas

BLAW-KNOX

BLAW-KNOX COMPANY
Equipment Division
Pittsburgh 38, Pennsylvania

Another new development using

B.F.Goodrich Chemical *raw materials*



"Showplace of the Nation," Radio City Music Hall uses cable insulated with Geon made by Plastic Wire & Cable Corporation, Jewett City, Connecticut. B.F.Goodrich Chemical Company supplies the Geon polyvinyl materials only.

Cable at Radio City Music Hall gets lighter touch from Geon

Changes in electrical setups backstage during shows at Radio City Music Hall were a problem because the electrical cable was so heavy—it took two men to lift a 100-ft. length. Now a new cable insulated with Geon polyvinyl material solves the problem—it is so light that one man can easily lift a 100-ft. coil.

In addition to being lighter, cable insulated with Geon is considerably reduced in bulk, making it easier for the set designer because it is ideal for hook-ups to lightweight backdrops. Geon-insulated cable lies flat, too, unlike old-style cable. It is excellent for use in traffic areas—like stages.

In a place where many people gather, safety is also a primary consideration. Again Geon scores—because it has excellent dielectric properties. Inspection authorities have approved. There are no braids to rot, or to wick moisture. There is no lead sheathing to corrode. And this insulation of Geon is strong, fire-resistant (will not support combustion), and has good flexing properties.

Here's another way Geon polyvinyl material is providing the key to new product applications. You can get more information by writing Dept. AT-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON polyvinyl materials • HYCAR rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

Let's take a closer look at Demand Metering . . .

Why Call it Demand?

Does the word "demand" make you bristle?

While we all know that demand charges are fully justified from the standpoint of basic economics, the electric power customer often fails to realize that it is he who is making demands on the utility rather than the other way around. If psychology has a place in rate-making, should the word "demand" have ever been admitted to the electric utility vocabulary?

Today, when demand metering is being applied to the measurement of more and more residential loads, seems to be a good time to reconsider our use of the word. Electric customers, tabbed with a *demand* charge on their electric bills, have a tendency to bristle at the term.

If we remove *demand* from demand metering, it becomes a more acceptable concept . . . and if we substitute a logical and less offensive word in its place such as load, peak, or power, we have a more readily understood term.

What's your suggestion? We would like to hear from you. Address Glenn M. DeKraker, Sangamo Electric Company, Springfield, Illinois.

Acknowledged Leadership in Demand* Measurement

Sangamo offers the most complete line of demand measuring devices in the industry —equipment to indicate and record demands from the smallest values to the largest encountered by the electric power industry. The line includes singlephase and polyphase mechanical demand registers, thermal demand meters, indicating and graphic meters, digital demand recorders and translating systems for Kw, Kvar, and Kva demand. You can look to Sangamo for all types of demand devices.

*Until you change the term "demand".

JH59-3

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Do you use THERMAL DEMAND?

The compact singlephase or polyphase Sangamo watthour and Lincoln demand meter combines the new features of Sangamo's watthour meters and Lincoln watt demand meters. These meters are calibrated at the factory to 1% of full scale.

Accuracy assured by carefully matched components that are completely shielded. Only two moving parts assure minimum maintenance.

Where future load growth is anticipated, capacity of the demand element can be doubled by changing two link connections and the demand scales.

. . . OR DO YOU PREFER

MECHANICAL DEMAND . . ?

Sangamo's new Type D mechanical demand register, when installed on any of the Sangamo extended range J2 and P2 watthour meters, gives the most accurate indicating demand measurement available. You get 1% full scale accuracy.

The heart of the demand register is the motor. With over two million Type H motors in service, it offers proven reliability in addition to higher torque, slower speed and higher insulation levels.

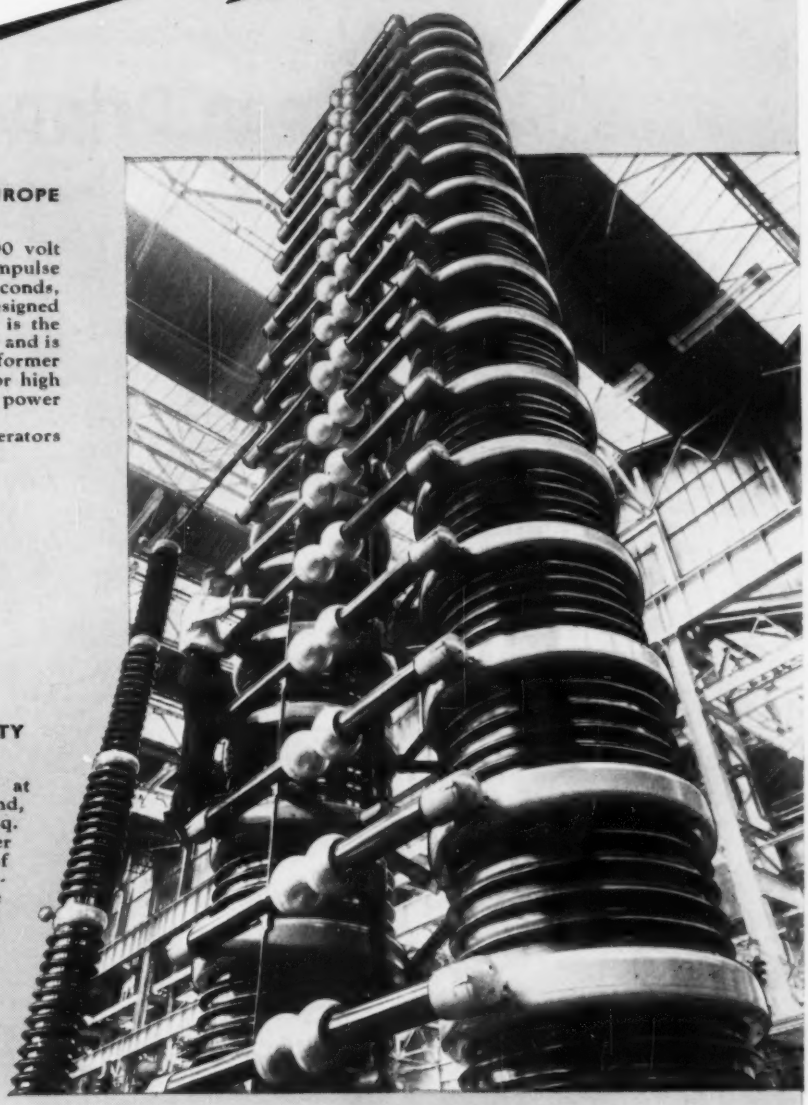
Universal and standard Type D registers were designed to give better disk visibility, better service accuracy, time interval indication, and simple disengagement of timing motor for register checking.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

50th ANNIVERSARY SANGAMO 1899 - 1949

4,000,000 VOLTS!



THE LARGEST
IMPULSE GENERATOR IN EUROPE

The illustration shows a 4,000,000 volt 18 stage, 2 column Ferranti Impulse Generator, energy rating 285 kW seconds, D.C. charging 220 kV per stage. Designed and built by Ferranti engineers, it is the largest impulse generator in Europe and is now installed in the Ferranti Transformer Factory at Hollinwood, England for high voltage impulse testing of large power transformers.
Ferranti High Voltage Impulse Generators are used throughout the world.

FERRANTI

OVER 5,000,000 kVA
per annum
of TRANSFORMER CAPACITY

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C. and D.C. Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI LTD

Head Office and Plant: **HOLLINWOOD · LANCASHIRE · ENGLAND**

OFFICES AND PLANTS

London Office: **KERN HOUSE · 36 KINGSWAY · W.C.2**

NEW YORK: Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y.20

TORONTO & ST. CATHARINES:
Ferranti-Packard Electric Ltd., Ontario, Canada

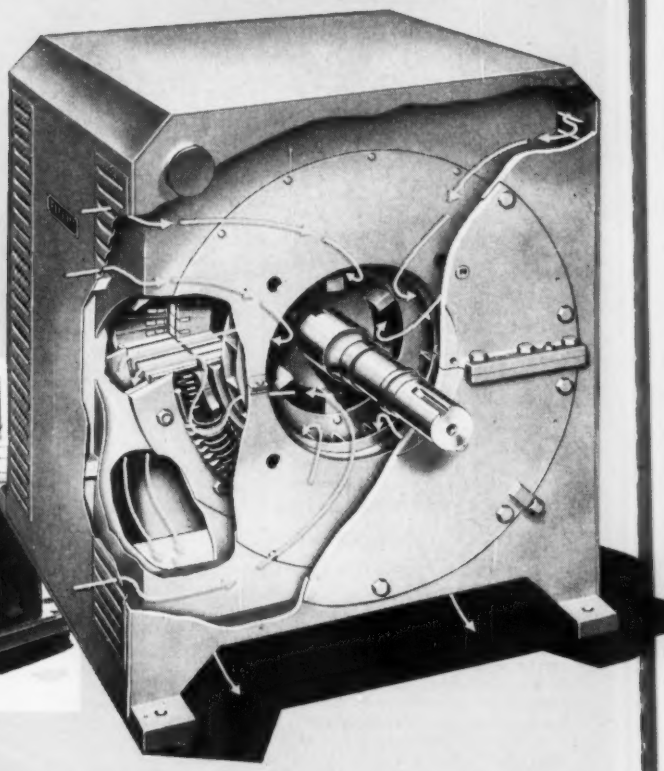
MOSTON: Manchester 10, England
WYTHENSHAWE: Manchester 22, England
WEST GORTON: Manchester 12, England
GEM MILL: Chadderton, Lancs., England
EDINBURGH: Ferry Road, Edinburgh 5, Scotland
DUNDEE: Kings Cross Road, Dundee, Scotland

FT176/2

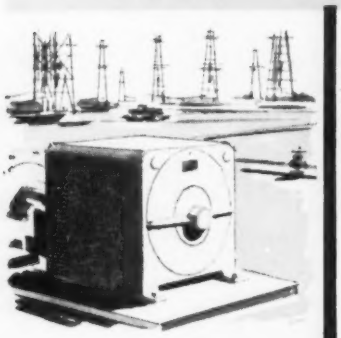
What's this ABOUT PUTTING

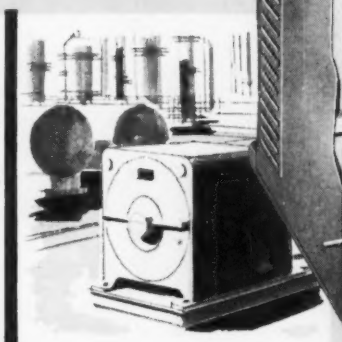
You can rely on Elliott Application Engineering.

Open Dripproof designs



Typical applications include outdoor installations (up to 5,000 volts) in petroleum, chemical, steel, mining, paper and many other industries.





AMPLE PROTECTION

for many applications and operating conditions due to the record-breaking performance of Fabri-Seal insulation

Today's large Elliott squirrel-cage induction motors with the now famous FABRI-SEAL coil insulation give you the most complete winding protection available. No other insulation system has such a long record of *proven* field service. Installed in over 2,000,000 hp of motors since 1948, FABRI-SEAL has chalked-up an *unmatched* 10-year operating record.

Note the excellent protection provided by the Elliott dripproof motor enclosure. Skillful arrangement of louvers and baffles prevents incoming air from impinging directly on the motor windings. The changes of direction imposed on the entering air help throw off entrapped moisture and dirt, protecting vital internal parts. This standard enclosure is not only dripproof, but offers splashproof protection equal to that of many splashproof enclosures.

ALL LARGE ELLIOTT INDUCTION MOTORS RECOMMENDED FOR OUTDOOR SERVICE FEATURE:

- protection of all metal parts from corrosion
- space heaters to prevent condensation during shutdown
- screens on air inlets to protect against debris

"INDOOR" MOTORS OUTDOORS?

Elliott engineers will carefully analyze your operating conditions and advise you frankly what type of motor enclosure will give your motors the protection you need . . . at lowest over-all cost.

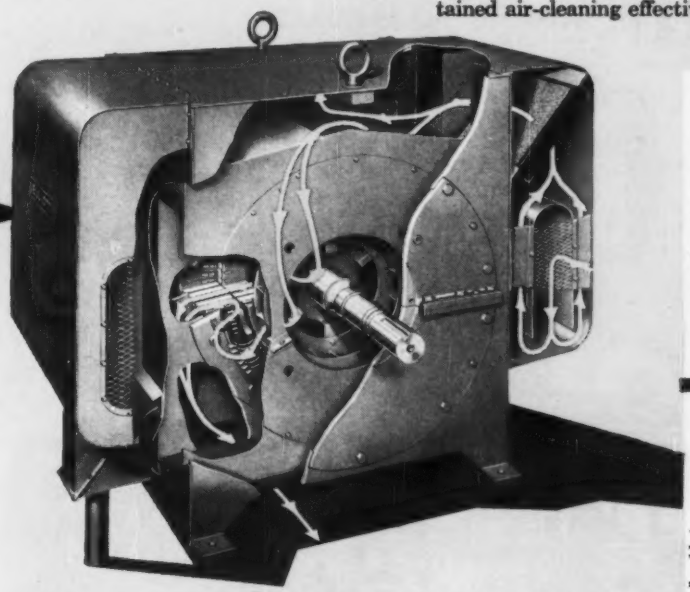
or Weather-Protected enclosures

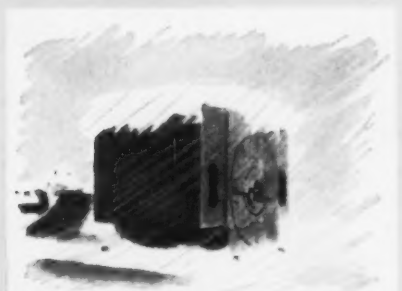
ULTIMATE PROTECTION

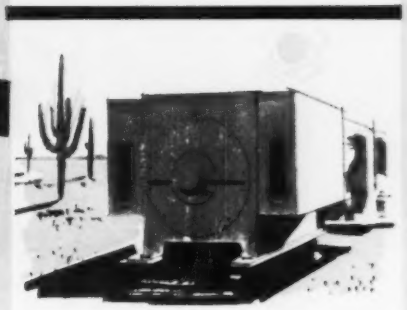
and assured continuity of service in the most severe conditions—driving rains, blizzards, hurricanes, salt spray, dust storms

Years ago, Elliott engineers foresaw the need for fully weather-protected outdoor motors for applications where wind and rain achieved hurricane proportions or where chemical fumes, salt spray, and extreme moistures prevailed. Such a motor would provide optimum reliability, insure continuity of service, and eliminate costly housing. Elliott subsequently designed and built such a motor—the first *really* "weather-protected" motor, with FABRI-STEEL construction and FABRI-SEAL coil insulation. Since 1948, more than 800,000 hp of these weather-protected motors have been installed and have achieved an unmatched 10-year field service record.

The cutaway illustrates how screened horizontal air inlets permit through passage of wind-driven rain, snow or sand; multiple baffles impose numerous direction and velocity changes on the entering air, assuring efficient removal of air-borne moisture; and (when desirable) large, cleanable air filters for maximum sustained air-cleaning effectiveness.







Typical applications include utilities, pipelines, refineries, chemical plants, and other outdoor installations involving severe weather or atmospheric conditions.

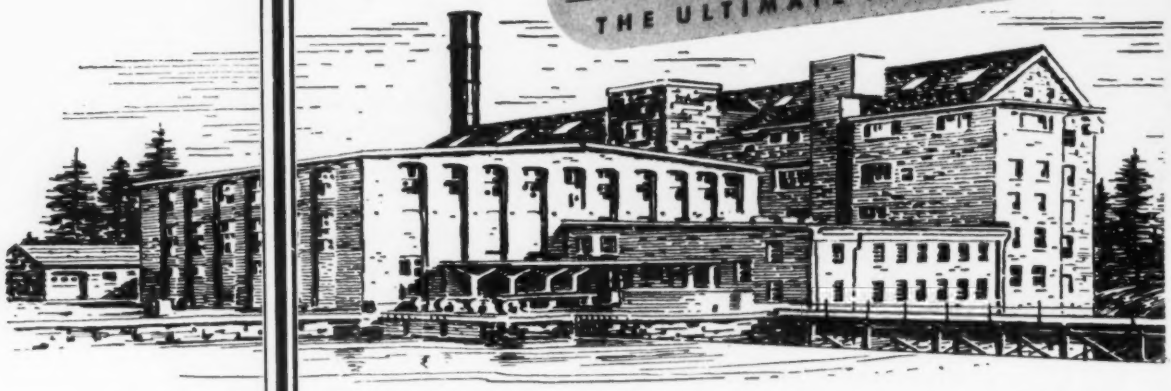
ELLIOTT Company
Ridgway Plant, Ridgway, Pa.

THE ULTIMATE IN MICA

You know that Mica is a natural product—
that it must be processed into usable form—
that who does the processing
and how is important—
When Mica is specified, go all the way
and specify

MACALLEN MICA
THE ULTIMATE IN MICA

send for Catalog



THE MACALLEN COMPANY, INC.

BAY ROAD
NEWMARKET, NEW HAMPSHIRE

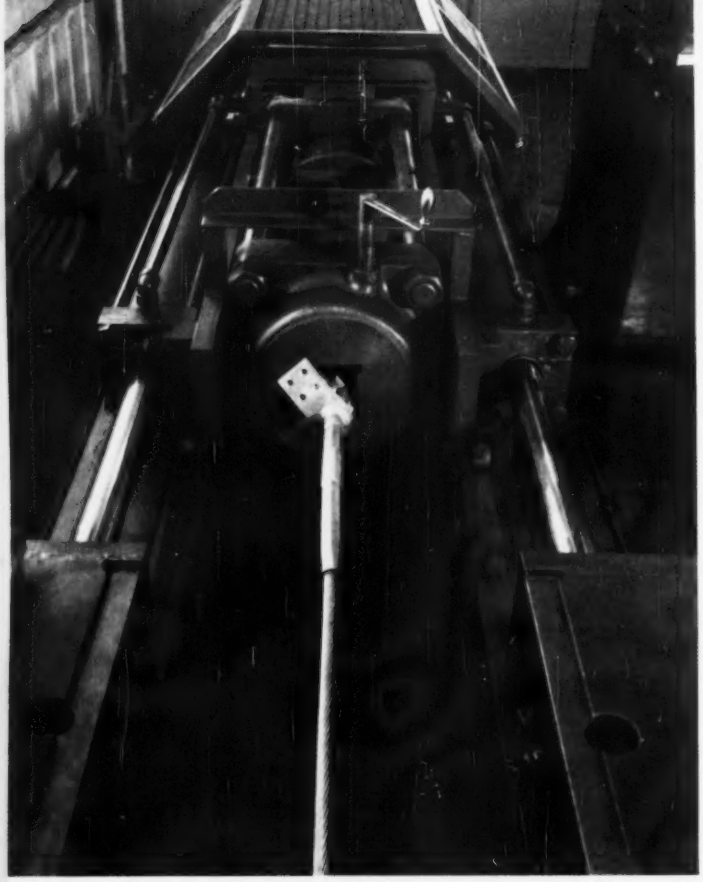
CHICAGO: 565 W. WASHINGTON BLVD.
CLEVELAND: 1231 SUPERIOR AVE.

Alcoa maintains a crew for work on the experimental outdoor test spans at Massena, N. Y. In photo above, linemen prepare to compress new tubular dead end with 100-ton Alcoa compressor. Note use of A.F.C.-Alcoa Filler Compound.

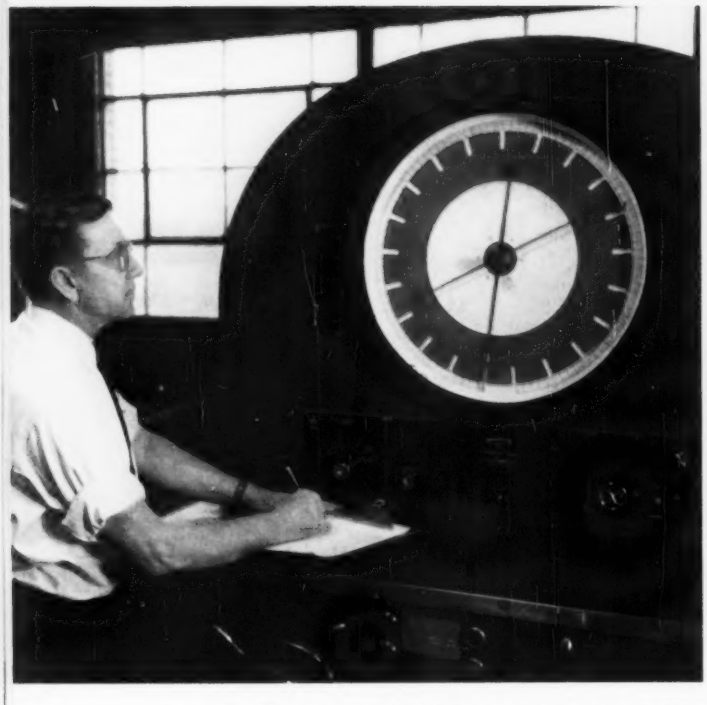
ALCOA RESEARCH

. . . development today for tomorrow's loads

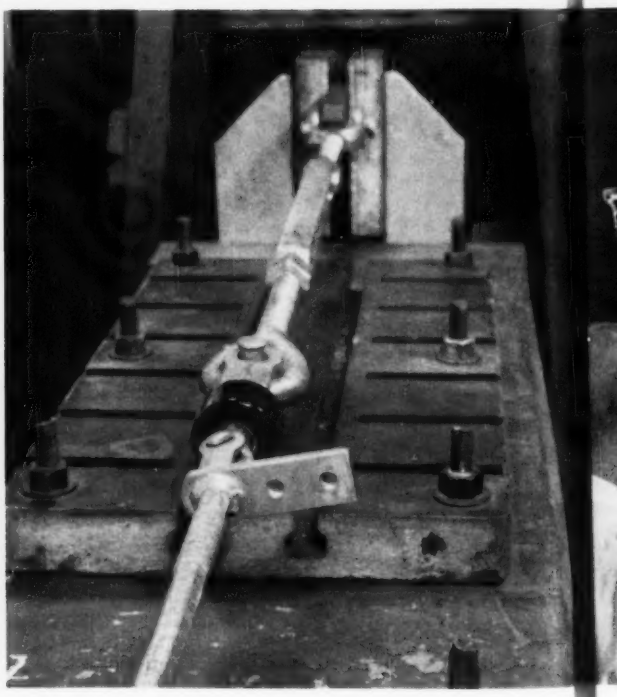
HOW ALCOA DEVELOPS NEW CONDUCTOR ACCESSORIES



NEW ALCOA TUBULAR ACCESSORIES PROVIDE ECONOMY WITH GREATER CONVENIENCE



Tension Tests assure that joints and dead ends in the new line successfully hold to tensions exceeding 95 per cent of the rated strength of the conductor. At tensions in excess of this accepted mechanical rating, failure will always occur in the conductor, never in the accessory.



Holding Tests over extended time periods prove that slippage of conductor in compression fittings does not occur even at higher than "in-service" tensions. Compressions do not loosen; there is no possibility of the conductor pulling out.

The facilities of Alcoa's Research Laboratories at Massena, N.Y., are devoted to all problems and developments related to aluminum conductors and their applications. Most recent of these developments is the announcement of a new line of tubular compression accessories for *all* standard transmission and distribution wire sizes.

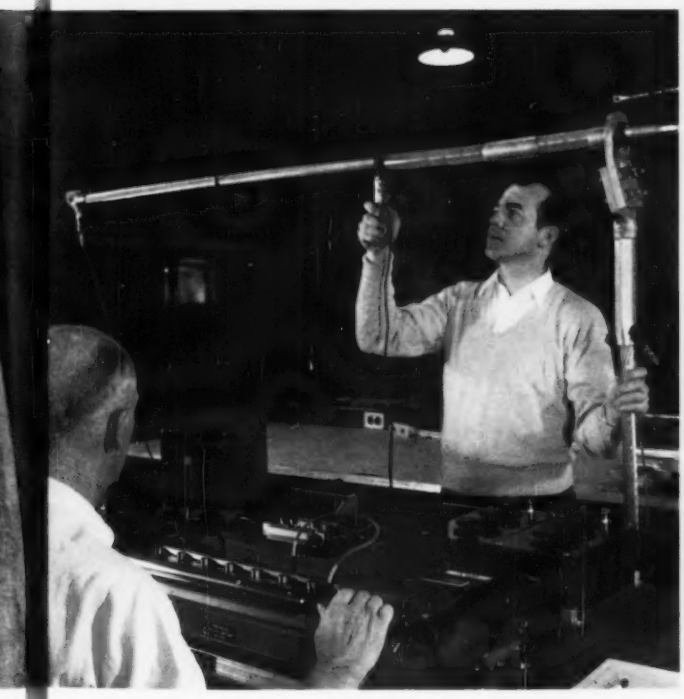
After several years of thorough testing in the laboratory and field, these conductor accessories offer you new conveniences and savings in the construction and operation of your lines.

Illustrated on these pages are several typical examples of the tests performed to prove that even the most severe electrical and mechanical requirements expected of Alcoa products are met and exceeded. The result is extended service life and trouble-free performance.

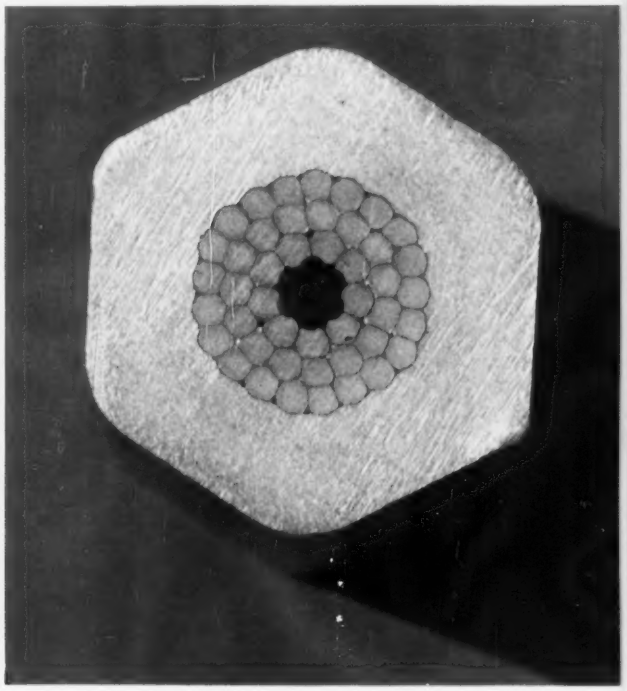
ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

ALCOA RESEARCH

. . . development today
for tomorrow's loads



Heat Cycling tests on compression accessories thoroughly determine maximum current-carrying capacity. Low initial resistance measurements across compression as well as bolted jumper connections remain low during and after current cycling.



Cross Sectioning of compressions determines how intimately compacted the conductor becomes with hexagonal compression die design. Superior electrical and mechanical joints are the result of fewer number of voids in the conductor.

NEW ALCOA TUBULAR ACCESSORIES ... EASY TO HANDLE ... EASY TO INSTALL

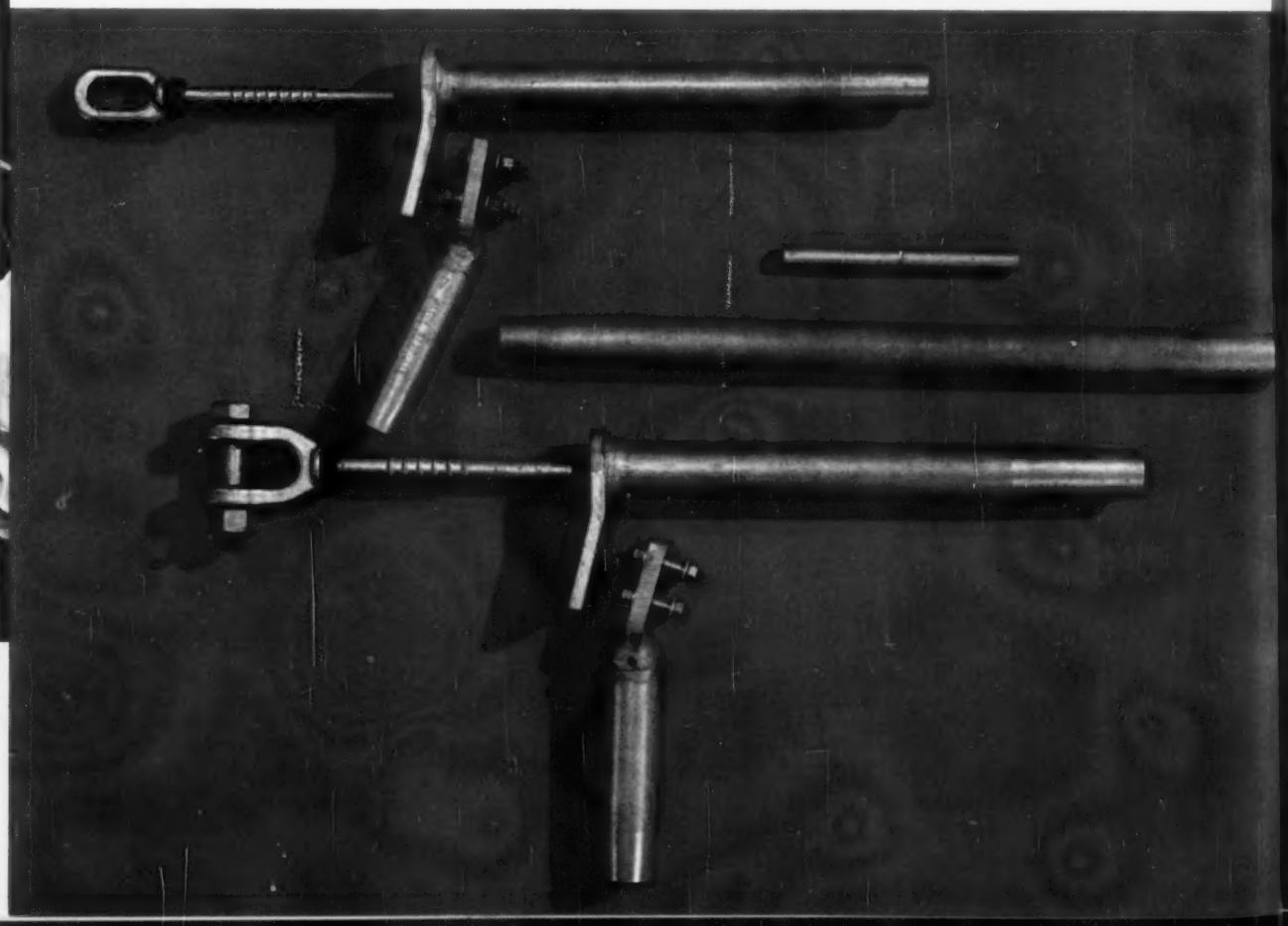
New Alcoa tubular accessories are easy to handle and install. Insertion of the cable is simple because of the smooth interior surfaces of the drawn tubular bore. Wire sizes from #4 through 1,590,000 cm can be worked in the air with a 60-ton press. Standard bolt hole spacing of dead-end tongues permits interchangeability so that all jumper terminals fit any dead-end body. For special installations, the tongue may be positioned radially about the axis of the conductor prior to compression. In addition, 15° angles on both dead-end tongues and jumper terminals allow the jumper loop to be placed in either perpendicular or 30° positions with the same accessories. The series of dead ends provides either eyes or clevises where construction practices make them most convenient. Catalog identification is clearly stamped on each accessory; dies required are stated; positions for compression are indicated.

These and other convenience features of the new, economical Alcoa tubular accessories facilitate neater, faster . . . and therefore less expensive . . . installations. Ask your Alcoa electrical sales engineer for complete information. Aluminum Company of America, 2110-G Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

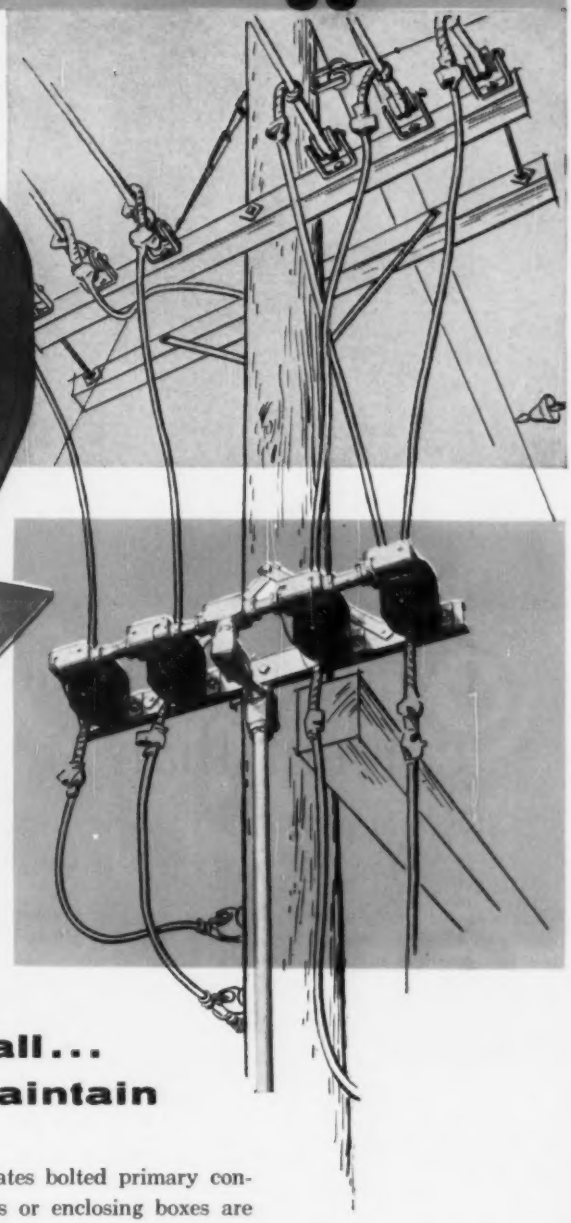
Your Guide to the Best in Aluminum Value

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV



ALLIS-CHALMERS modern line for '59

600-VOLT
Thru-Type
CURRENT TRANSFORMER



Easy to install... even easier to maintain

Install in minutes — Thru-type design eliminates bolted primary connections. Mount it in any position. No hangers or enclosing boxes are required. Large oval window holds two 750 MCM insulated cables.

No maintenance needed — Molded of epoxy-resin, this transformer never needs painting. It has excellent dielectric properties and can withstand wide temperature variations and severe mechanical shocks.

Get the complete story from your A-C man or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

A-C ALLIS-CHALMERS

A-5945-E

Even your dome light draws more current than MOTRAC 2-way radio!

Motorola ends costly power drain problems and idling expense with the first fully transistorized receiver and power supply

What makes Motorola MOTRAC radio the most economical and reliable 2-way radio unit in the annals of mobile communications? Not just one or two new features, but a score of revolutionary design advancements that bring you the very finest set ever engineered.

1. On standby—the MOTRAC receiver draws only a trickle of current—actually 80% less than conventional units—with an occasional increase to maintain crystals at proper temperature for precise on-frequency operation (even your dome light draws more current than MOTRAC radio). Yet, this radio is always poised for instant reception, thanks to its fully transistorized receiver. Result: no life-shortening battery drain . . . no more costly, unnecessary engine idling.

2. MOTRAC radio eliminates the most common maintenance problems: vibrators in the power supply and tubes in the receiver. All are replaced by stabilized long-life transistors.

3. Up to 40°F cooler operation means less aging and strain on components. Reason: no more receiver tube filaments; a more efficient power supply; a battery saver switch to cut off transmitter filaments; and two separate heat sinks—one for power supply, another for transmitter output tubes.

4. The MOTRAC receiver operates directly from the 12-volt battery; its low voltage operation results in less electrical strain on components, assures long life.

5. Traditional Motorola engineering and production excellence are evident throughout MOTRAC radio. Transistors undergo three separate checks, including a week of stabilization at 185°F. Only industrial-type tubes, especially suitable for the rigors of mobile operation, are used in the transmitter.

6. Patient production testing continues under stringent quality control procedures. First, each module is tested. Then each chassis is independently checked. Next, each radio is tested as a composite whole. Finally, the entire radio and associated accessories are checked out as a complete operating system.

7. MOTRAC radio is conservatively designed. The receiver has *even higher* reserve gain than conventional Motorola units to assure *peak performance* for many years. Also, power supply transistors are operated under an exceptionally high safety factor to assure extended service life.

8. Completely independent receiver and transmitter chassis, with no power supply in common, assure reliable reception regardless of transmitter performance.

9. MOTRAC radio offers you 2½ to 3 times higher audio output than conventional sets.

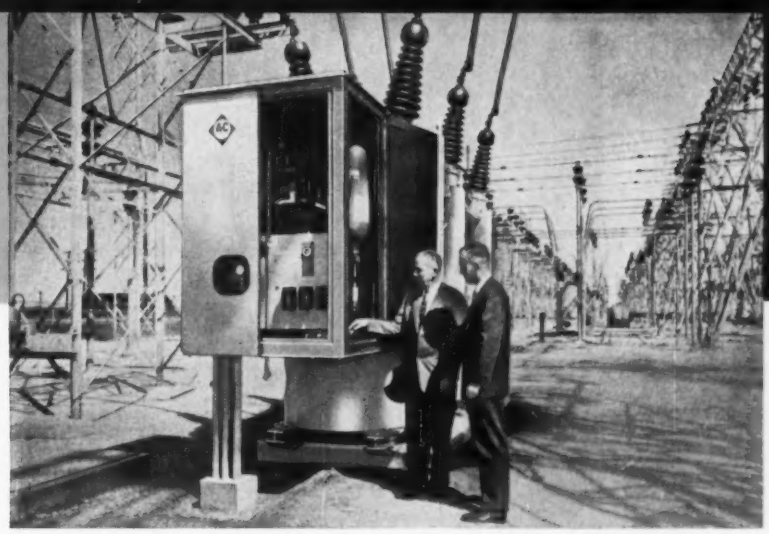
10. MOTRAC radio is designed for split-channel operation. *Both* receiver and transmitter meet critical split-channel stability frequency requirements.

Experienced users have been field testing MOTRAC radios for many months. The results are in—and they're excellent. We'd like to tell you *all* about them. Write, wire or call: Motorola Communications & Electronics, Inc., A Subsidiary of Motorola, Inc., 4501 West Augusta Blvd., Chicago 51, Ill., SP 2-6500. MOTRAC is a Motorola, Inc. trademark.

ALLIS-CHALMERS modern line for '59

C. M. Ripple, plant superintendent, and L. O. Sharp, Jr., assistant plant superintendent at W. A. Parish power plant, shown with one of eight 138-kv Allis-Chalmers breakers in switchyard.

Look at the record at Houston Lighting & Power Company



H. C. Taylor, electrical supervisor Power Department, and A-C's J. O. Higgins in Deepwater power plant switchyard.

Ten Allis-Chalmers breakers with *Pneu-Draulic* operators have been in service nearly five years. Eight additional units installed a year ago bring to eighteen the total number in use by the company.

In fact, the excellent performance of Allis-Chalmers breakers with *Pneu-Draulic* operators has led to their use on over 100 power systems. Repeat orders have been received from more than 60.

Behind this story is design leadership in power circuit breakers. A-C has led the way to fully mechanically trip-free operation and high speed arc interruption, as well as simplified operator design as represented by the *Pneu-Draulic* operator.

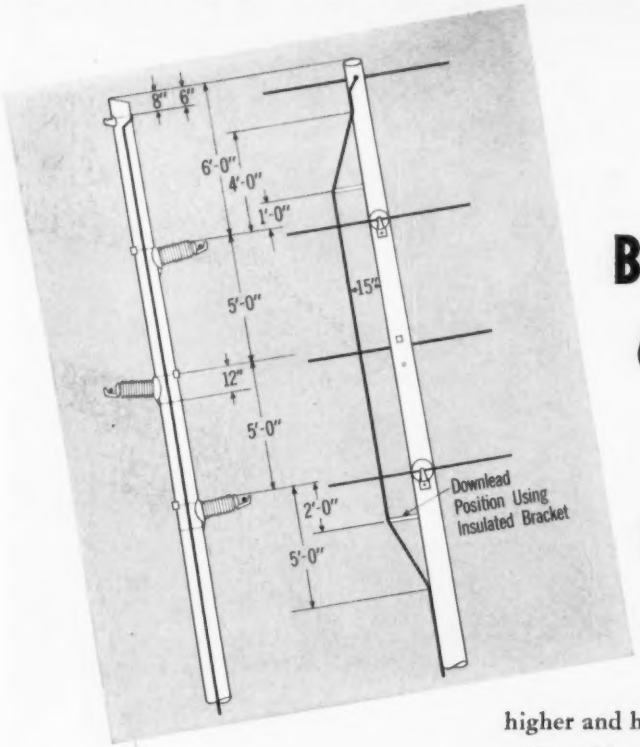
Get details from your nearby A-C office, or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin

Pneu-Draulic is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

A-1035-E

IMPORTANT COST REDUCTION IN TRANSMISSION LINE CONSTRUCTION



Build this 69 kv transmission line with only 7 bolts per structure

Here is a line design that reduces the labor component of construction cost. Good news for builders that find labor factors higher and higher!

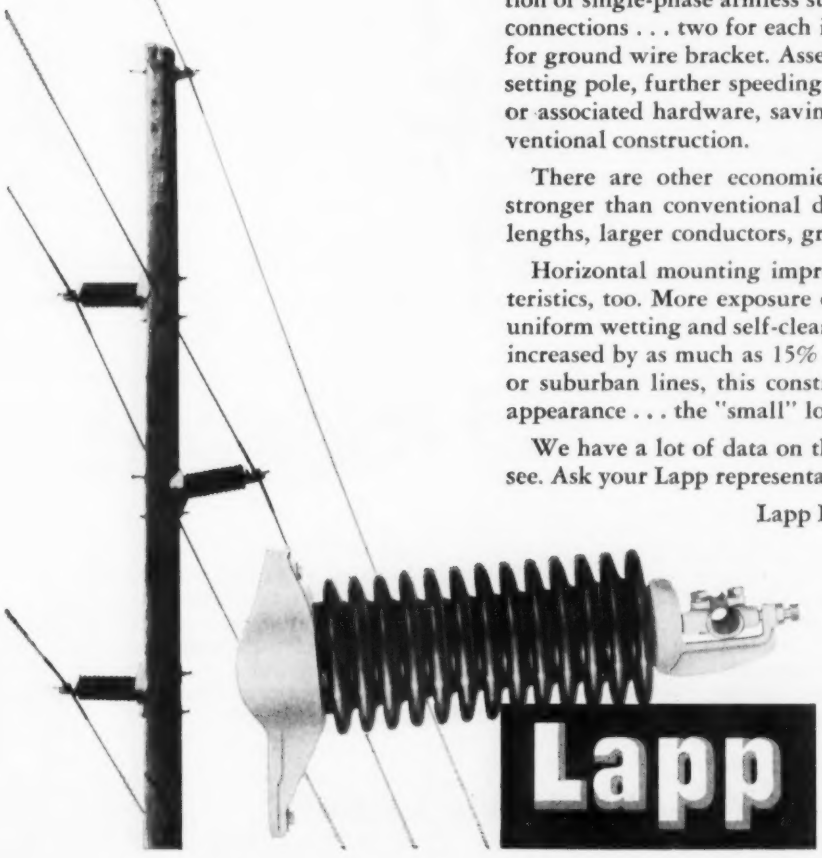
Use of horizontally-mounted Lapp Line Posts permits erection of single-phase armless structures, with only seven bolted connections . . . two for each integral-gain-base insulator, one for ground wire bracket. Assembly is done before raising and setting pole, further speeding erection. Without arms, braces, or associated hardware, savings are an actual 25% over conventional construction.

There are other economies also. Armless structures are stronger than conventional designs, permitting greater span lengths, larger conductors, greater factors of safety.

Horizontal mounting improves insulator electrical characteristics, too. More exposure of insulator surfaces encourages uniform wetting and self-cleaning . . . wet flashover values are increased by as much as 15% over upright ratings. For urban or suburban lines, this construction offers trim, unobtrusive appearance . . . the "small" look of a distribution line.

We have a lot of data on this construction that you should see. Ask your Lapp representative or write:

Lapp Insulator Co., Inc., Le Roy, N. Y.



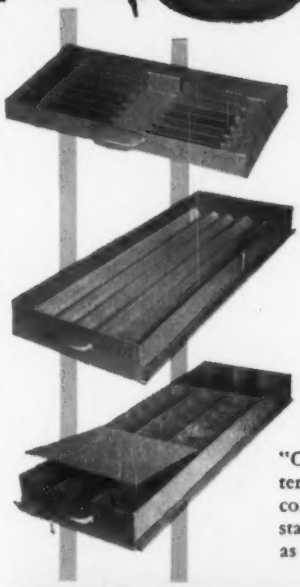
public utility men prefer—

YORK-HOOVER
YMR-76 Service Bodies

MODERN

PROVEN

EFFICIENT



"Custom" features such as material drawers with adjustable compartments are available as standard or optional equipment, as required.

LESS SERVICE HOURS . . .

plus extra savings in operators time are the results obtained by hundreds of YMR-76 Service Bodies in operation today. That's because YMR-76 units are compact and rugged . . . provide ample and convenient carrying space for materials and tools . . . with capacity for adjustment to meet changing conditions. Write for complete details, price and delivery information today!

CLIP AND MAIL TODAY!

Dept. 1E, York-Hoover Corporation
York, Penna.

Please send me a copy of Bulletin No. 942 covering your YMR-76 Service Body.

Name_____

Company_____

Address_____

City and State_____

BODY DIVISION
YORK-HOOVER CORPORATION
YORK, PENNSYLVANIA

CREATIVE ENGINEERING FOR THE PUBLIC UTILITY INDUSTRY SINCE 1892

Gas Tempering: **Report No. 1**

Electric Utilities Find
Safe Superheater

Metal Temperatures Across Width of Superheaters of Typical B&W Boilers with Gas Tempering

BOILER No. 1

Average Metal Temperature	1040 F	
Deviation		±40

BOILER No. 2

Average Metal Temperature	1035 F	
Deviation		±50

BOILER No. 3

Average Metal Temperature	1125 F	
Deviation		±45

Gas Tempering Assures Tube Temperatures

Longer Tube Life
Less Superheater Maintenance
Need For High Alloys Minimized

The ideal gas temperature to which superheater tubes should be exposed is the lowest temperature that will provide the required superheat and reheat with a reasonable amount of surface. If this temperature is exceeded in order to make a larger proportion of the total heat released in the furnace available for superheating and reheating, alloy requirements are increased and there is greater danger of superheater tube failure.

Now, the required heat can be delivered to the superheater *without exceeding desired metal temperatures* by the use of Gas Tempering.

Gas Tempering—is the reintroduction of cool flue gases near the furnace outlet to control the temperature of the furnace gases entering the superheater. It allows you to control furnace exit gas temperatures under all operating conditions.

Definitive Booklet: If you'd like to learn more about the economies and design flexibility available to you through Gas Tempering, write for Bulletin G-96. Address: The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

Major Advantages of B&W Gas Tempering

. . . It cuts overall plant costs because the smaller size unit requires a smaller building per kw, a lighter foundation, less structural steel and shorter steam leads.

. . . It enables you to utilize the most economical available fuels. It permits the burning of a variety of coals without slagging, minimizes external corrosion of superheater tubes, and assures safe metal temperature, thus prolonging tube life, regardless of the fuel fired.

. . . It provides safe superheater tube temperature by positive gas temperature control; it protects superheater during startup and under all operating conditions.

. . . It makes it safer to design for economies offered by operation at steam temperatures of 1050 F and above.

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

G-936

Power Boost with **PARANITE®**

Consolidated Edison is meeting the challenge of mounting demands for electrical power with a systematic program of replacement and expansion. Selected to help carry this ever-increasing load in the Metropolitan New York area is Paranite "Network Power Cable" . . . one of the many Paranite products which backs up a reputation . . . "IF IT'S PARANITE IT'S RIGHT®"

Why PARANITE "NETWORK CABLE?"

Paranite Network Cables are engineered, manufactured, tested and have been proven in installation to meet the severe demands of seasonal peak loads. The consistent performance of Paranite marks it as a product of close quality control!

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Fort Wayne 6, Indiana

MANUFACTURING PLANTS: Birmingham, Ala.; Anaheim, Calif.; Jonesboro, Ind.; Marion, Ind.; Tiffin, Ohio

Sales Offices in all Principal Cities

This "gold meter," General Electric's 10,000,000th magnetic-suspension meter, has just come off the assembly line at Somersworth, New Hampshire. It is a reminder that not one of the first 9,999,999 has ever been replaced because of bearing wear.

OVER 10 YEARS AND 10,000,000 METERS . . .

Not one General Electric magnetic-suspension meter has ever been replaced because of bearing wear

This month, eleven years since the introduction of the revolutionary I-50, General Electric's Meter Department produced the 10,000,000th meter with magnetic suspension. Of the first 9,999,999, not one "free-floating" system has ever been replaced because of wear. This service record stands as indisputable proof that General Electric meters, with magnetic suspension, assure a lifetime bearing system. Here's how it started:

Meter men for many years had requested a meter with a lifetime bearing system. In 1948, General Electric introduced the I-50—first of the magnetic-suspension meter family—as the answer to that request. Because of the widespread acceptance of the I-50 and the need to handle increasing loads, General Electric introduced the Class 100 I-55 in 1954 and the Class 200 I-60 in 1957. With the extension of magnetic suspension to the complete polyphase Class 10, 100 and 200 V-60 two-stator line, General Electric's full line of watthour meters has achieved an unexcelled record for accurate performance.

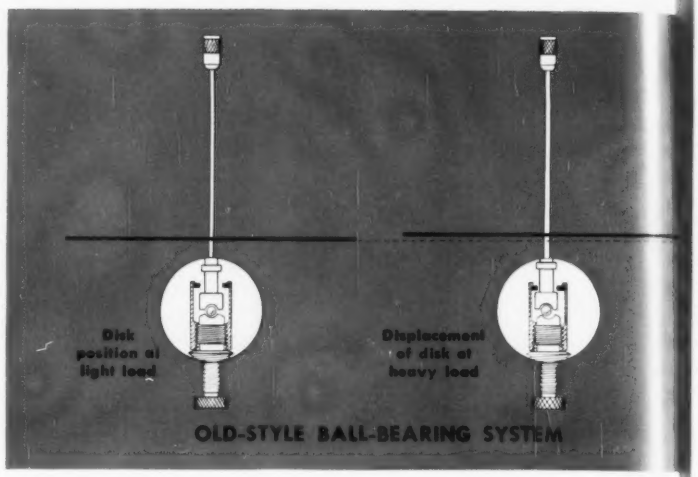
Progress Is Our Most Important Product

GENERAL ELECTRIC

HERE'S 5-WAY PROOF OF MAGNETIC-SUSPENSION

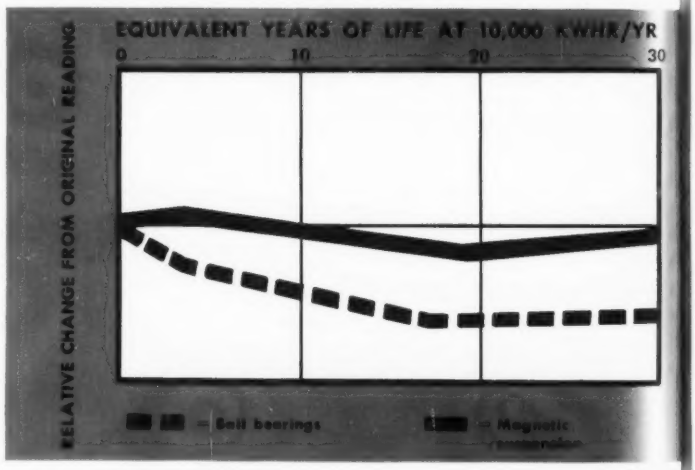
1 NO DISK DISPLACEMENT

With conventional ball-and-jewel bearing systems, higher loads can force the disk out of position and cause inaccurate meter readings. Because of the basic design of General Electric's magnetic-suspension system, however, disk displacement at any load is not a significant factor, and meter readings are accurate through full meter range. You also eliminate bearing inspection, cleaning and replacement costs.



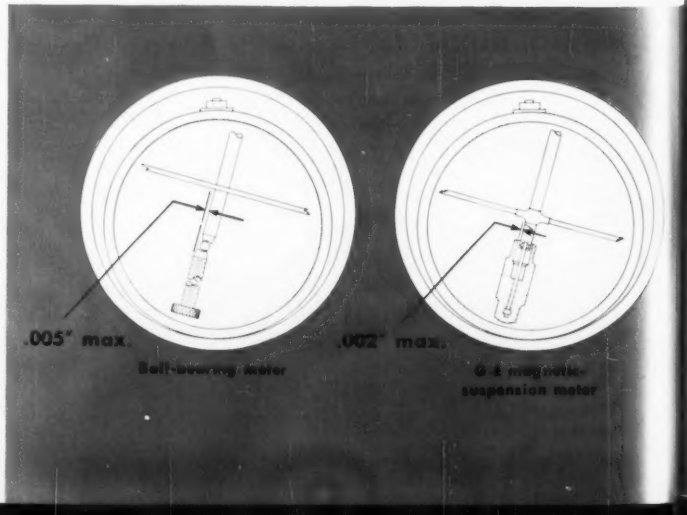
2 GREATER SUSTAINED ACCURACY

The proof is in the testing. Accelerated life tests prove that, over an equivalent of 30 years' operation at 10,000 kilowatt-hours per year, meters with magnetic suspension hold a higher sustained accuracy and incur considerably less bearing wear than meters with old-style, ball-bearing systems.



3 REDUCED TILT ERROR

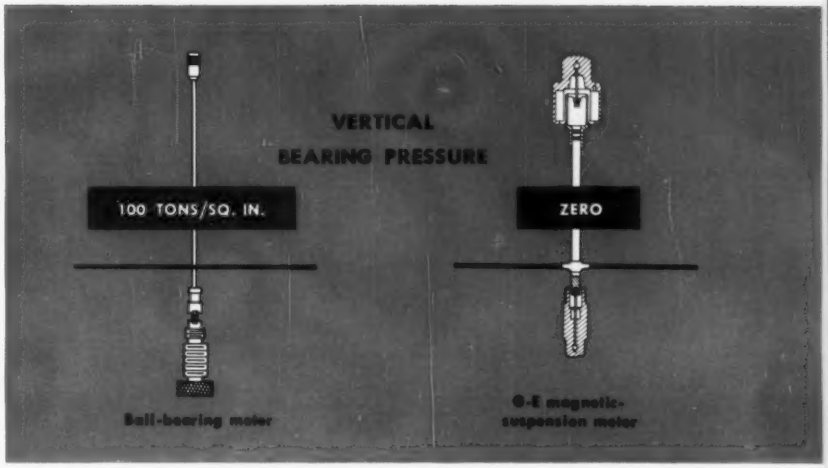
Because the disk and shaft in G-E meters are supported magnetically rather than by a ball and jewel, tilt error is minimized. As the angle of tilt is increased on ordinary ball-bearing meters, disk position changes—relative to the element and damping magnet—result in increased tilt errors. Close tolerance of parts in G-E meters minimizes disk position changes and tilt error, thus reducing revenue losses.



GENERAL ELECTRIC'S METER SUPERIORITY

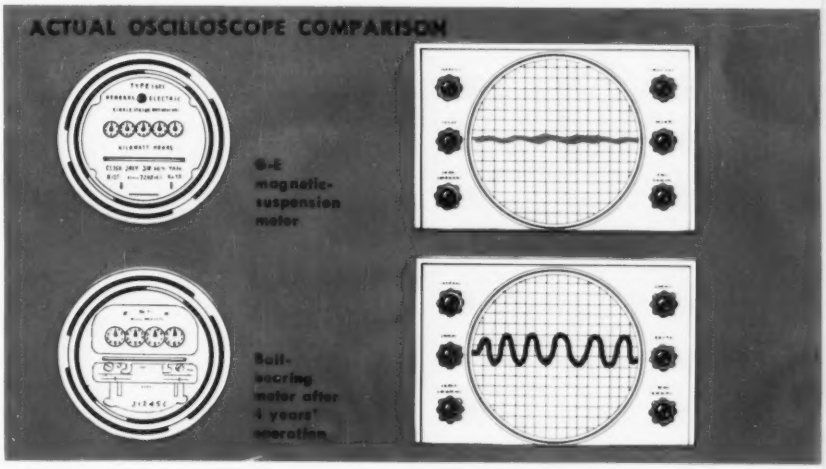
4 NO BEARING WEAR

In old-style, ball-and-jewel systems, the weight of the disk and shaft assembly exerts approximately 100 tons-per-square-inch pressure on the bearing. Bearing wear and attendant maintenance costs are inevitable. With G-E's magnetic-suspension system, vertical bearing pressure is zero because the entire weight of the rotor is supported by a magnetic field. Only G-E meters offer a true, lifetime bearing system.



5 QUIETER OPERATION

Electric Utilities across the country have recorded instances where home owners have registered complaints about "noisy meters" outside nurseries or bedrooms. Where noise constitutes a problem, it has become common practice to replace old-style, ball-bearing meters with General Electric magnetic-suspension meters. G-E meters operate more quietly because the disk floats free.



TEN MILLION METERS WITHOUT A SINGLE BEARING FAILURE PROVE THE SUPERIORITY OF GENERAL ELECTRIC'S MAGNETIC-SUSPENSION SYSTEM

For complete information on this exclusive meter line, contact your G-E apparatus salesman or write section 628-29, General Electric Company, Schenectady 5, New York.

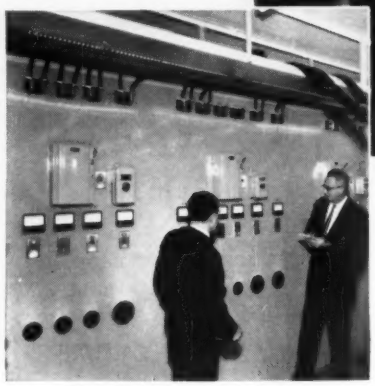
Progress Is Our Most Important Product

GENERAL ELECTRIC

Blackburn's

New Testing Facilities

give accurate test data for utilities, precise evaluation of design ideas

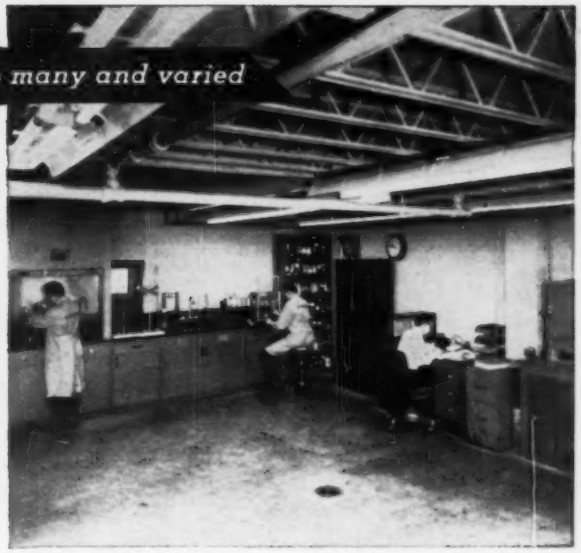


PART OF THE CONTROL PANEL of Blackburn's recently completed current cycling laboratory. John A. Toedtman, Chief Engineer (left), and Ken Way, Vice President, observe tests in progress.

NEW CURRENT CYCLING LABORATORY features virtually draftless air conditioning and a means of closely controlling ambient temperatures throughout the test area. Control of these factors permits truly precision testing of connectors. This photo shows Blackburn laboratory technicians taking resistance and temperature measurements of test connections. These new facilities permit testing of more than 500 connectors simultaneously. Advanced testing facilities like these enable Blackburn to provide you with the proper fitting for every operating condition.

. . . and the tests are many and varied

THE GENERAL LABORATORY, a portion of which is shown here, is the scene of a great variety of tests. Hardness, yield and breaking strength of parts such as castings, bolts, etc., are determined. Special equipment is available for pull-out or holding force evaluation of all fittings. Clamping force measurements giving the relationship between tightening torque and the force exerted by the connector on the conductor are made here. Microscopic examinations and special electrical resistance measurements are routine. Tests like these give Blackburn fittings great dependability.



THE CHEMICAL LABORATORY is the center for tests to control various chemical process solutions used in production. Electroplating, etching, and metal cleaning solutions are regularly tested here. In addition, special surface treatments are evaluated for friction control and corrosion protection. Thus, this laboratory assures continuous control of quality.

SALT FOG CHAMBER, where tests may continue for hundreds or even thousands of hours. Here salt fog tests are made on wire connections. Test conditions are made in accordance with ASTM specifications. Electrical resistance measurements and visual observations are recorded at regular intervals during the tests.

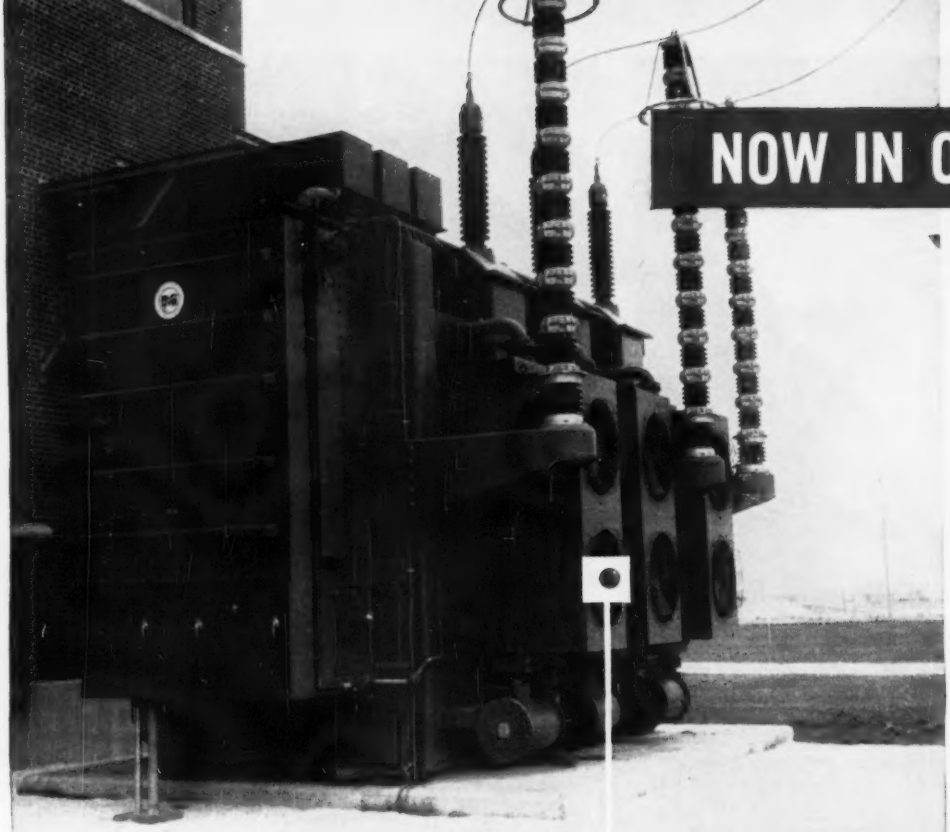
OUTDOOR EXPOSURE RACKS permit long-term exposure tests which often yield valuable information on weathering resistance not accurately obtainable from more highly accelerated tests. Specimens on these racks generally remain on test for at least a ten-year period.

Look to BLACKBURN for *test-engineered* electrical fittings

JASPER BLACKBURN CORPORATION

1525 Woodson Rd. • St. Louis 14, Mo. • WYdown 3-9430

NOW IN OPERATION



Equipped with a type MH LTC mechanism in which Moloney's rotary type load transfer switch serves as the sole current interrupter leaving the tap selector mechanism arc free.

The load transfer switch also by passes the reactor on full cycling positions thereby eliminating reactor loss and voltage drop.

Connected to the generator through isolated phase bus duct and equipped with forced oil-to-air heat exchangers, the unit makes a compact, unencumbered installation.

MOLONEY ELECTRIC

SALE

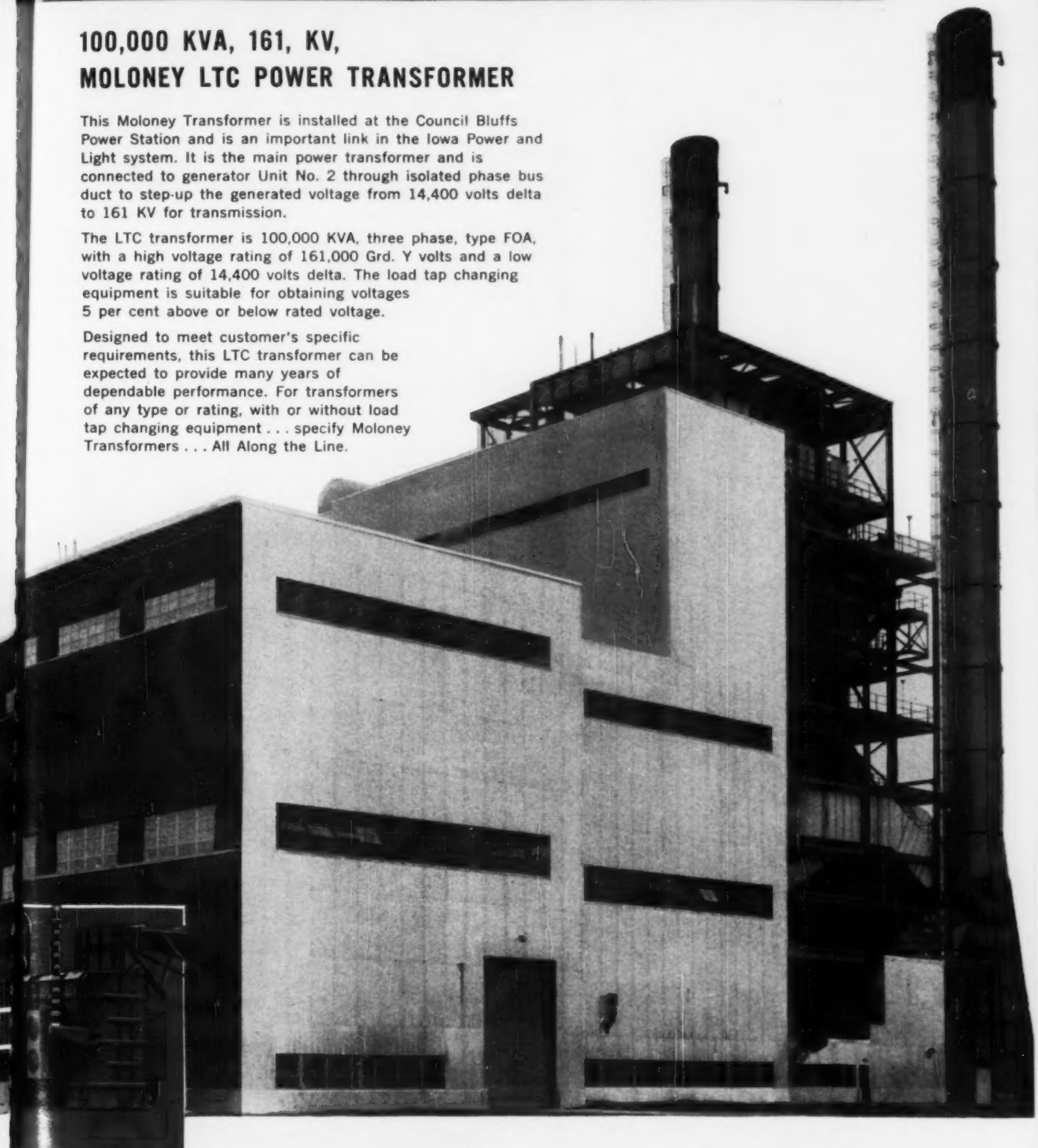
FOR IOWA POWER AND LIGHT COMPANY

100,000 KVA, 161, KV, MOLONEY LTC POWER TRANSFORMER

This Moloney Transformer is installed at the Council Bluffs Power Station and is an important link in the Iowa Power and Light system. It is the main power transformer and is connected to generator Unit No. 2 through isolated phase bus duct to step-up the generated voltage from 14,400 volts delta to 161 KV for transmission.

The LTC transformer is 100,000 KVA, three phase, type FOA, with a high voltage rating of 161,000 Grd. Y volts and a low voltage rating of 14,400 volts delta. The load tap changing equipment is suitable for obtaining voltages 5 per cent above or below rated voltage.

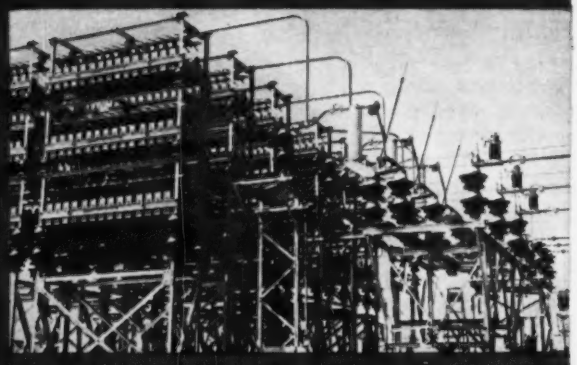
Designed to meet customer's specific requirements, this LTC transformer can be expected to provide many years of dependable performance. For transformers of any type or rating, with or without load tap changing equipment . . . specify Moloney Transformers . . . All Along the Line.



MOLONEY ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

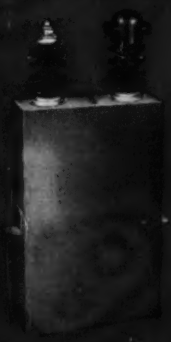
creative engineering in action



Photograph above of 50,400 KVAR, 69 KV capacitors at a Pacific Coast installation shows series-parallel arrangement and stacking of units.

some say that all electric utilities are alike ... that they all do pretty much the same job with similar equipment. For some people, maybe that's true. But not for Tobe.

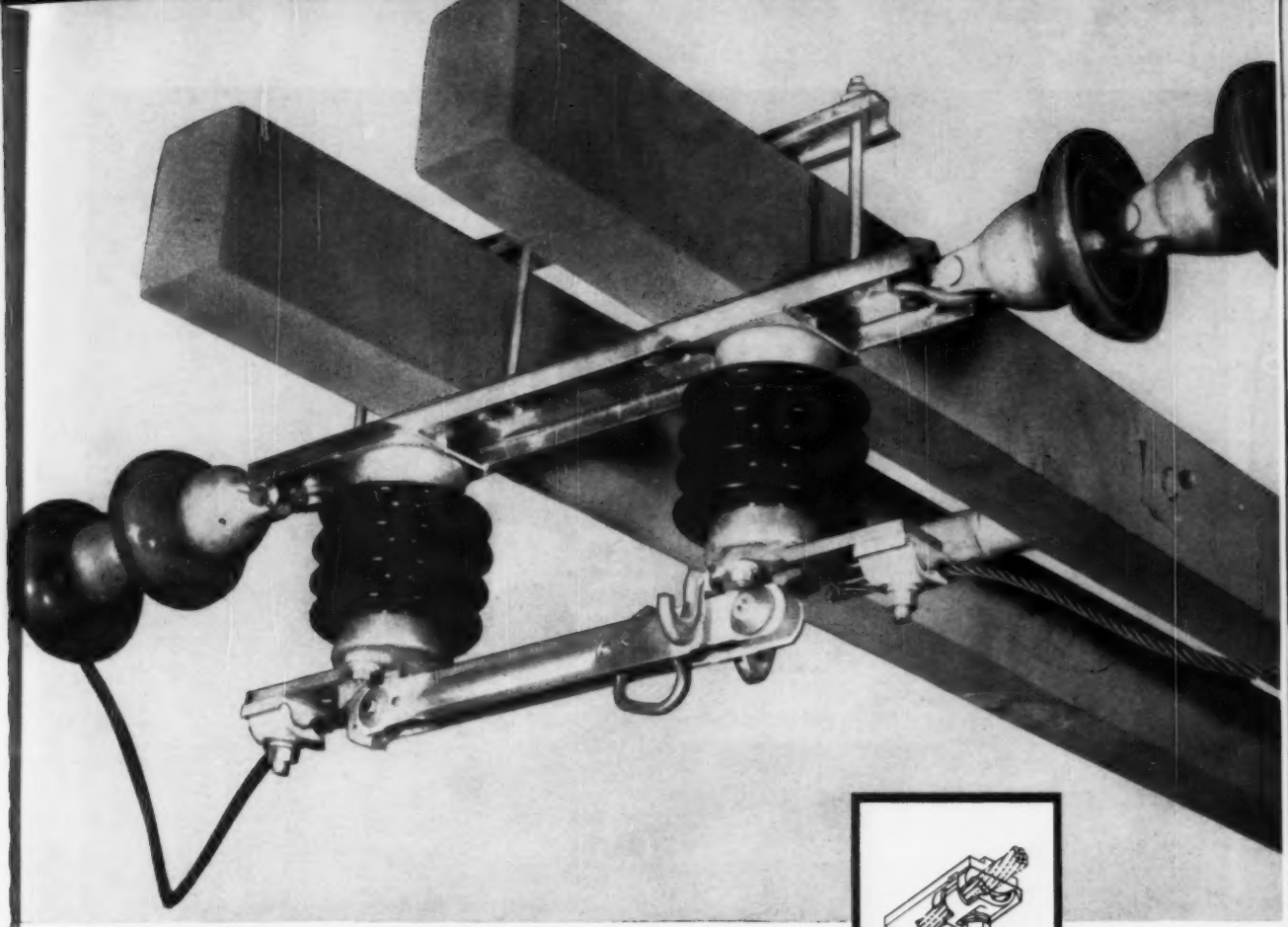
Tobe knows that for all their similarities, no two utilities face the same problems. That's why Tobe brings to each assignment—be it power-factor correction or thermonuclear-energy research—the fresh thinking, the unique solutions that 50 years of capacitor design and manufacturing experience can supply. That's also why the industry looks to Tobe for progress. Talk about similarities. Tobe and "creative engineering in action" are synonymous. Write for catalog today. Tobe Deutschmann Corporation, Norwood, Massachusetts.



50KVAR POWER CAPACITOR

TOBE

TEMPALL CAPACITORS



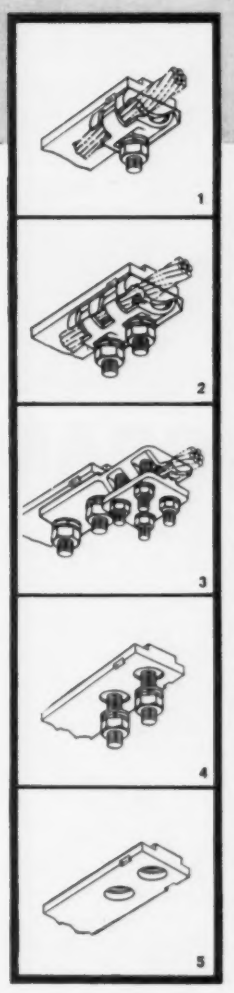
S&C LOADBUSTER DISCONNECT rated 400 amps continuous, 15 kv, 95 kv BIL. For use with LOADBUSTER® S&C's portable loadbreak tool

Now with S&C LOADBUSTER DISCONNECTS you have widest choice of connectors

No matter what your connector preference, you can satisfy it with S&C's LOADBUSTER DISCONNECTS. Here's why: You can get a choice of two new styles of groove-type connectors (details at right) and three NEMA Standard pad terminal connectors. Not enough?

You can also have the LOADBUSTER DISCONNECT with aluminum or bronze captive bolts—an S&C first—for hot-line tool installation of compression connectors. Or, if you prefer, you can obtain this disconnect without any connectors or connector hardware.

For more details please write for Bulletin 721. S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill.



1. NEW Bronze groove-type connector. Single bolt, captive for hot-line tool handling. Takes No. 2 solid through 500 Mcm stranded copper.

2. NEW Aluminum alloy groove-type connector. Zinc-tin plated, two bolt, captive for hot-line tool handling. Takes No. 2 solid copper through 500 Mcm stranded copper or aluminum.

3. NEMA standard pad terminal connectors for copper conductor. Three sizes: No. 6 solid through 2/0 stranded; 2/0 solid through 4/0 stranded; and 250 Mcm through 500 Mcm.

4. NEW Aluminum or bronze captive bolts. Will take your choice of connectors—compression or other types.

5. NEW. Any connector can be used with this terminal pad. It has standard NEMA drilling—two 9/16" holes on 1¾" centers.

S&C ELECTRIC COMPANY

New ORANGEBURG® CA* CONDUIT *with Flush Coupling Attached!*

With no separate couplings to handle or attach on the job, Orangeburg CA lays faster, costs less to install. Each long, light length has a *flush* coupling attached at one end and a standard 2° male taper at the other end, making installation a simple, one-step operation. And, since the coupling *is* attached, there are no coupling cartons to warehouse or carry to the job.

What's more, with the coupling *flush* to the conduit's outside wall, new CA is easy to stack, store and handle. The flush coupling also eliminates "staggered" joints in the trench. And that means real savings in cutting and tooling time.

Like the hundreds of millions of feet of Orangeburg fibre conduit in use since 1893, new CA has self-sealing joints and impermeable walls. Its smooth, 100% fibre raceway adds years to cable life.

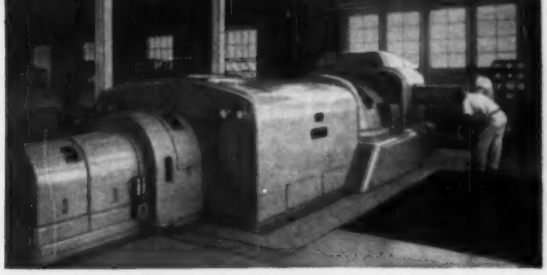
New Orangeburg CA is available in 2", 3", 4", 4½" and 5" sizes. Orangeburg Standard and Nocrete Conduit, with separate sleeve couplings, are available as always. Write Dept. EW-79 for Catalog 52.

ORANGEBURG MANUFACTURING CO.
Orangeburg, New York • Newark, California
A Division of The Flintkote Company, Manufacturers of America's Broadest Line of Building Products

Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.

One reason why Fairfield, Illinois has efficient electric service-

Nonpareil Turbine Oil



Plant superintendent James Easton and Standard Oil industrial lubrication specialist Charlie Brown inspect 5,000 kw. Worthington turbine, one of four turbines in Fairfield Municipal Light & Power Company plant lubricated with NONPAREIL Turbine Oil.

These turbine installations trace the record of growth in electric power consumption in Fairfield, Illinois, over the past 19 years:

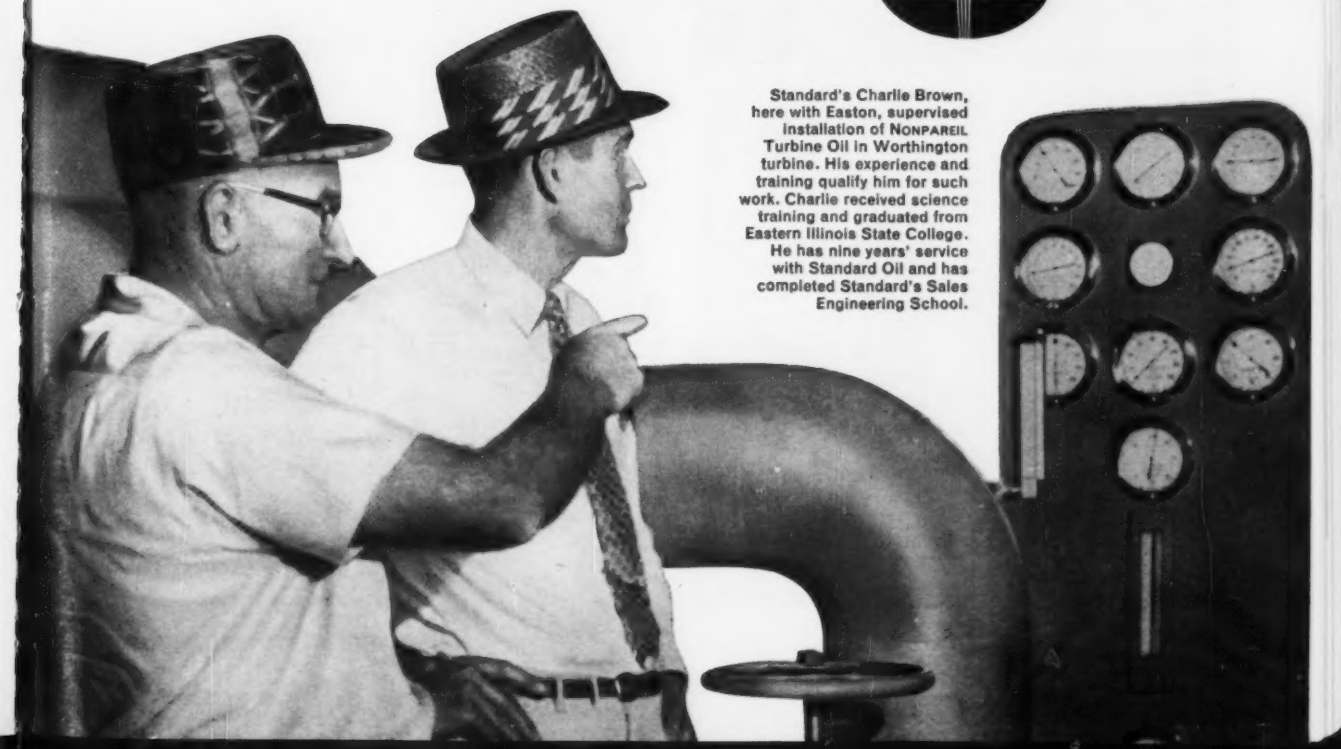
Type	Turbine Cap.	Installed
Westinghouse	1,500 kw.	March, 1940
Westinghouse	2,500 kw.	March, 1942
Westinghouse	4,000 kw.	March, 1949
Worthington	5,000 kw.	July, 1957

When the first turbine went into service, Fairfield Power plant management decided upon a turbine lubricant they felt would be dependable—NONPAREIL Turbine Oil. Standard Oil, they found, would give them concrete evidence of the oil's dependability. They received a certificate guaranteeing that, for the life of the turbine, the acidity of the oil would never exceed 0.15 mg. KOH/g. Indeed, through the years the oil has remained at a much lower acidity level, usually in the order of 0.06 mg. KOH/g. Periodic analysis of the oil in Standard's Whiting laboratory confirms that the oil is performing according to guarantee.

The kind of service Fairfield Municipal Light & Power gets from NONPAREIL Turbine Oil comes about this way: NONPAREIL is the subject of special refining techniques and handling. A special crude is used as a base stock. All sludge-forming compounds are removed. An oxidation inhibitor which permanently controls acidity is added. No sweetening or resting of NONPAREIL Turbine Oil is required at any time.

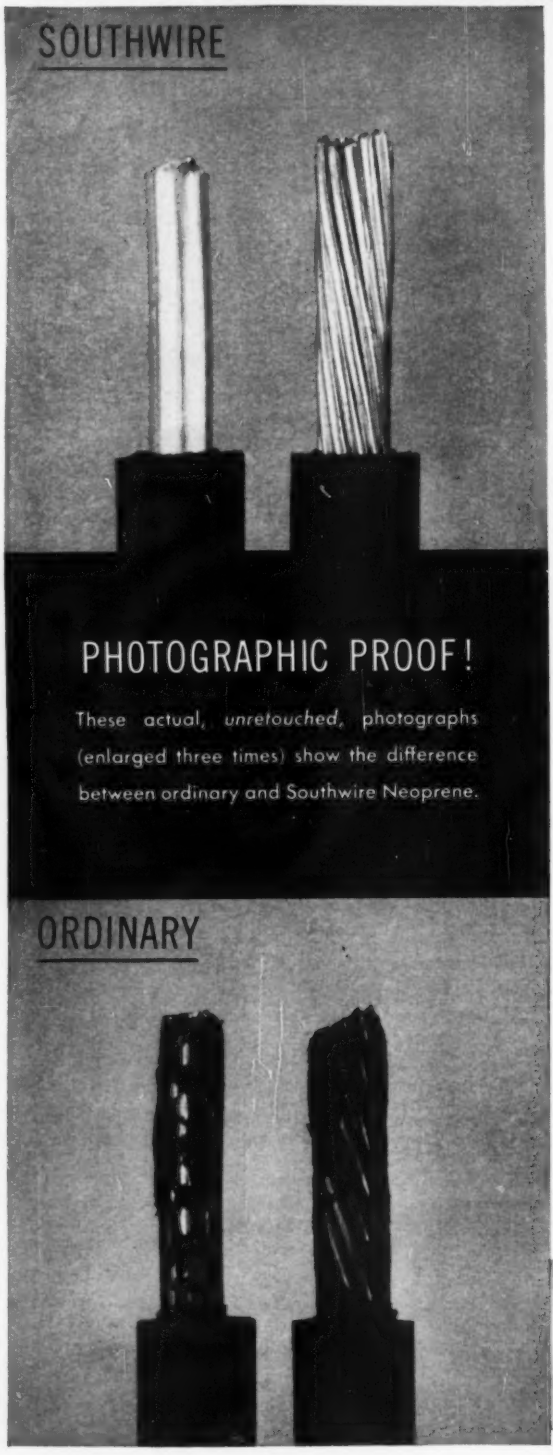
Men with experience in turbine lubrication can give you more facts about NONPAREIL Turbine Oil. Call your nearby Standard Oil office in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

You expect more from **STANDARD** *and you get it!*



Standard's Charlie Brown, here with Easton, supervised installation of NONPAREIL Turbine Oil in Worthington turbine. His experience and training qualify him for such work. Charlie received science training and graduated from Eastern Illinois State College. He has nine years' service with Standard Oil and has completed Standard's Sales Engineering School.

100% FREE STRIPPING
100% OF THE TIME!


SOUTHWIRE
PHOTOGRAPHIC PROOF!
These actual, *unretouched*, photographs (enlarged three times) show the difference between ordinary and Southwire Neoprene.
ORDINARY

SOUTHWIRE

NEOPRENE COVERED COPPER

Get what you pay for when you order free stripping Neoprene Covered Copper Wire and cable—not just some of the time, but every time!

Southwire's compounding and extruding techniques, developed only after long and exhaustive testing, are your guarantee of premium quality—and long, trouble-free conductor performance.

Southwire Neoprene is consistently 100% free stripping. It will not stick—even to stranded wire. It will not discolor the copper. Wires need no scraping before connections are made.

And there is no premium in price for this superior product—another Southwire first!

- **NO STICKING — NO DISCOLORATION**
- **NO SCRAPING NEEDED FOR CONNECTIONS**
- **NO PREMIUM IN PRICE**

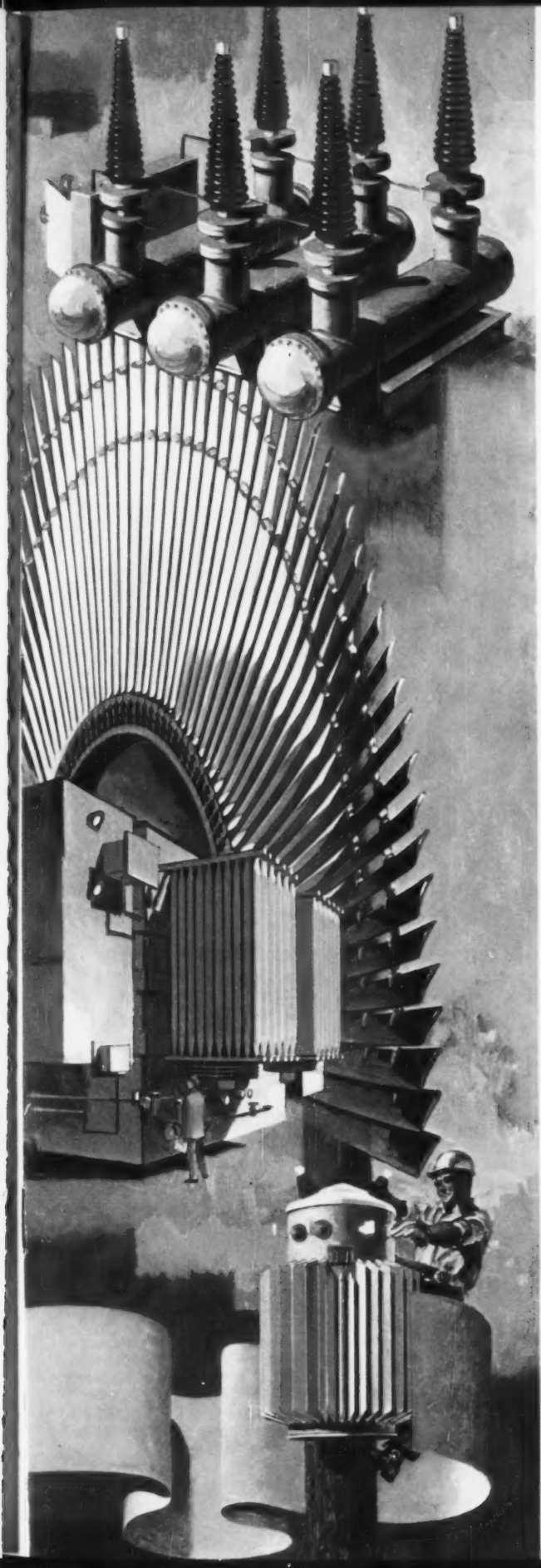
FREE SAMPLES AND TECHNICAL DATA ON REQUEST

SOUTHWIRE serves the world

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- NM Sheathed Cable
- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

Southwire Company

TErrace 2-6311 CARROLLTON, GEORGIA



on the way from WESTINGHOUSE products for your supersystem

Spectacular growth in utility loads in the 1960's and 1970's is certain. Over one and a quarter trillion kilowatt hours is the power market projected for 1969. To produce energy on this scale will require a generating capacity of 295 million kilowatts . . . more than twice today's capacity.

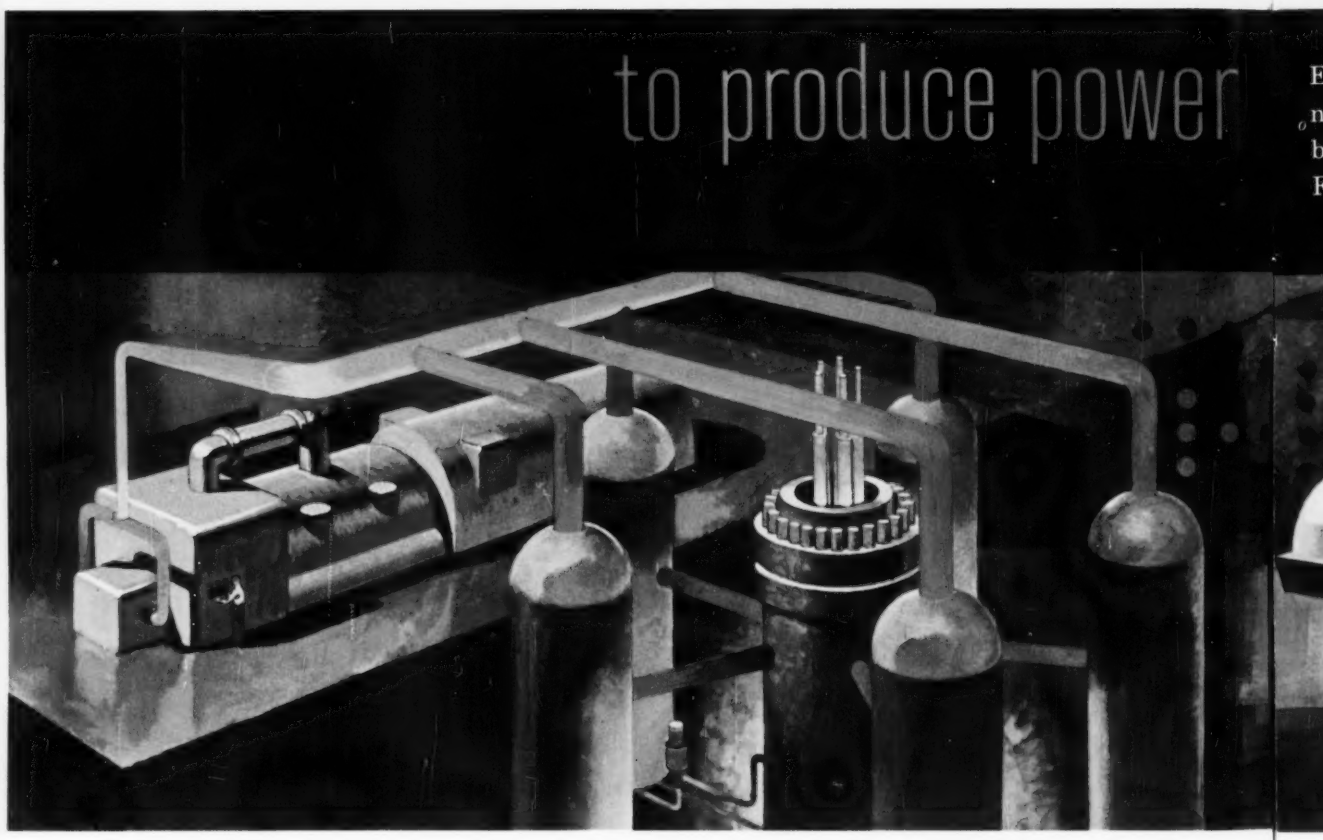
What is the pattern of your future system?

In the era of the superload, the supersystem will emerge . . . complex beyond anything seen or experienced to date. Heavier demands on our fossil fuels will necessitate many nuclear power plants. Your generating stations may be completely automatic. To move bulk power economically, you will transmit at higher voltages. To handle system peaks, you may be sharing capacity to a greater degree than ever with neighboring systems through interconnection. Doubled distribution voltages may be your only answer to meeting residential loads.

Westinghouse can bring you the products you will need to meet these requirements. Westinghouse has built some of these products. For the others, basic design and engineering work has been completed. Read this story on the following seven pages.

WESTINGHOUSE

is ready today to build products



Westinghouse is now ready to build a 330,000-kw nuclear power plant

Westinghouse offers this nuclear generating station for service on your system in 1965. This plant will compare in capacity with the largest fossil fuel plants required to meet present standards of economical generation. Power cost? Competitive with fossil-fueled plants in some areas of the country today.

Through comprehensive evaluation of dozens of possible reactor designs, Westinghouse has concluded that no one nuclear power plant is ideal for all times, or every utility power need. The most promising reactor types are currently under intensive development. For generating stations of the size now being added to utility systems, the pressurized water reactor is the only nuclear plant sufficiently advanced and proved to be offered for immediate construction.

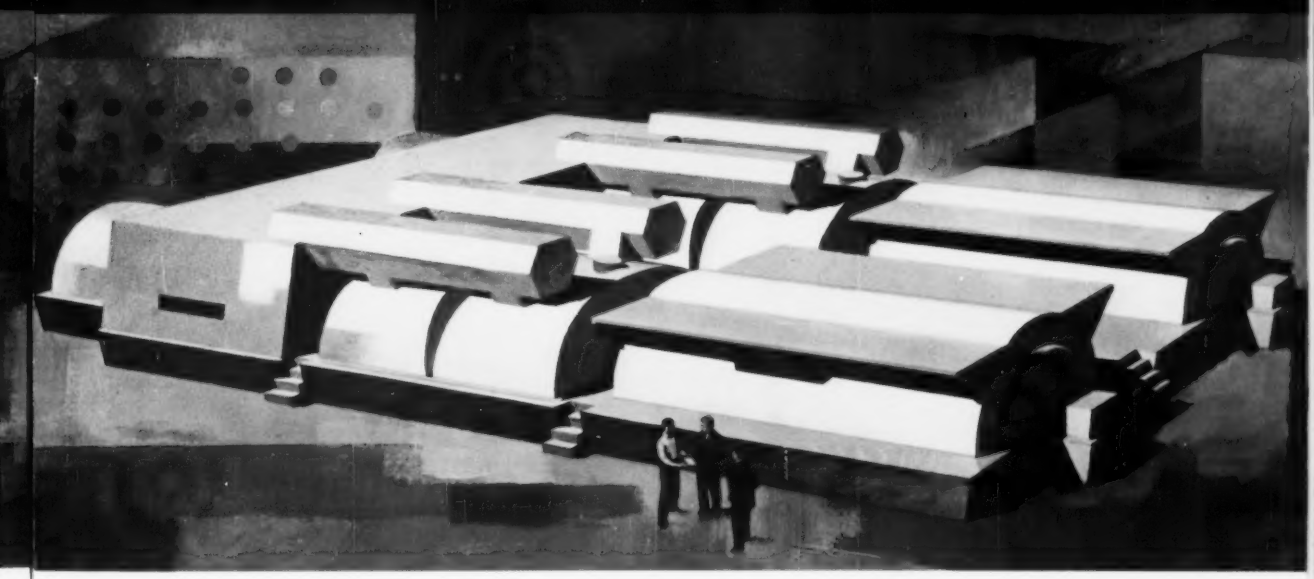
This plant is a result of the $40 million nuclear power investment by Westinghouse to make world-wide power generation from the atom practical, economical.

Westinghouse is ready to build unprecedented 800,000-kw turbine-generator now . . . almost twice the capacity of the world's largest today

From Westinghouse research has come a new 28-in. exhaust end blade capable of 25 percent more power than any that have preceded it. Cross-compounding with four exhausts on each of two 3600-rpm shafts, this blade makes possible an 800,000-kw turbine-generator unit. Here is tomorrow's turbine-generator

for your future system

Experience to understand total system operation . . . For decades, a special staff of engineers at the Westinghouse Electric Utility Engineering Department has been applying a bold mixture of technical knowledge and imaginative thinking to broad system problems. From long-range studies, basic concepts of power systems of tomorrow are being created.



to supply massive amounts of low-cost, dependable electric power to a growing American economy.

Another turbine-generator of tomorrow is already in production at Westinghouse. The highest pressure, highest temperature turbine ever undertaken is the 1200° F, 5000-psi unit for the Eddystone Plant of the Philadelphia Electric Company. Because temperatures in this range are far beyond the capability of ferritic materials, this turbine uses austenitic alloys. Over-all station heat rate will be about 8100 Btu per kwhr—the most efficient in the world. This machine will produce 10 percent more power from the same amount of fuel than any now in operation.

Efforts to wring more and more power out of a pound of coal do not end with these giants. A combined gas-steam plant is coming. The same combustion source provides steam for the steam turbine and heat for the gas turbine. Result? Higher thermal efficiency.

With two outstanding breakthroughs, Thermalastic® insulation and Inner Cooling, Westinghouse generators have kept—even exceeded—the pace of power generation needs. A 384,000-kva generator is being built; even higher ratings are in the offing. Generators can be built now to match any turbine that can be built, any system plan that can be devised.

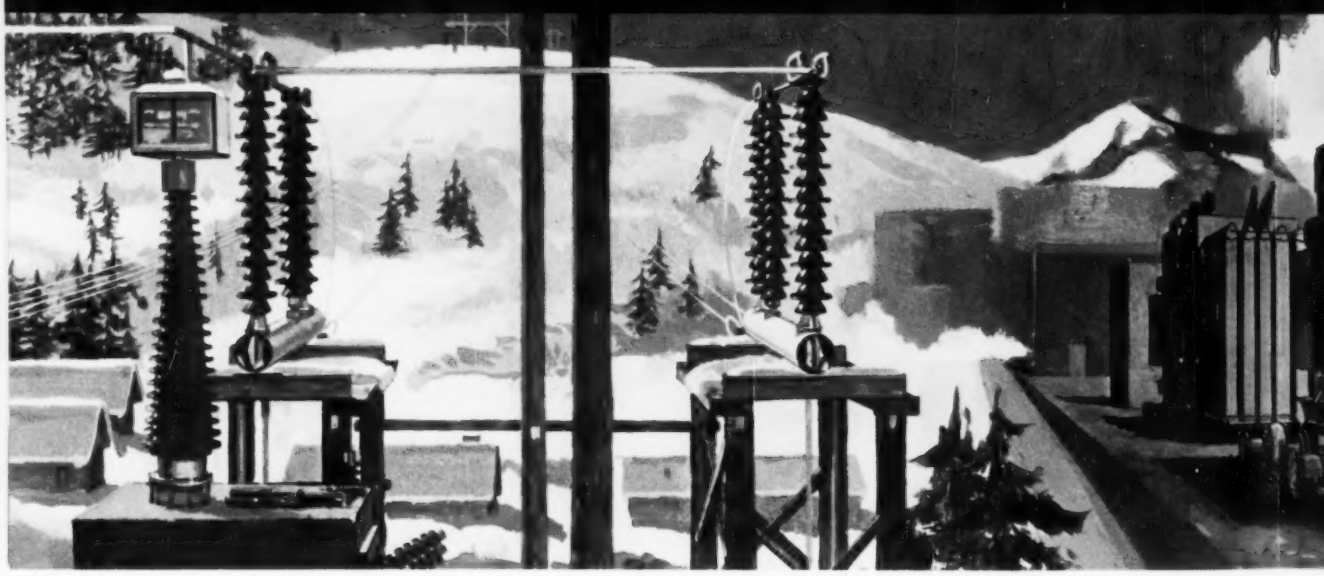
This generating equipment can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

YOU CAN BE SURE...IF IT'S **Westinghouse**

WESTINGHOUSE

is ready today to build products

to transmit power



Westinghouse is ready now to build power transformers for 690-kv systems

The great hinge on which the design of transformers of the future swings is extra-high voltage. The Tidd project of the American Electric Power Company, begun 13 years ago, proved that EHV transmission at 345 kv, 460 kv and above was practical and dependable. All operating conditions that could be expected were simulated. Today, transformers, power breakers, arresters and disconnect switches operate at extra-high voltages successfully on hundreds of miles of circuits.

Three years ago, a laboratory of rocks and snow, the Rockies, began yielding a wealth of data for design and operation under extremes of weather and high altitudes, furthering EHV studies. Sponsored by the Public Service Company of Colorado at Leadville, Colorado, this broad investigation of corona and radio influence, switching surges, conductor sizes, reduced insulation levels and economics of EHV is continuing.

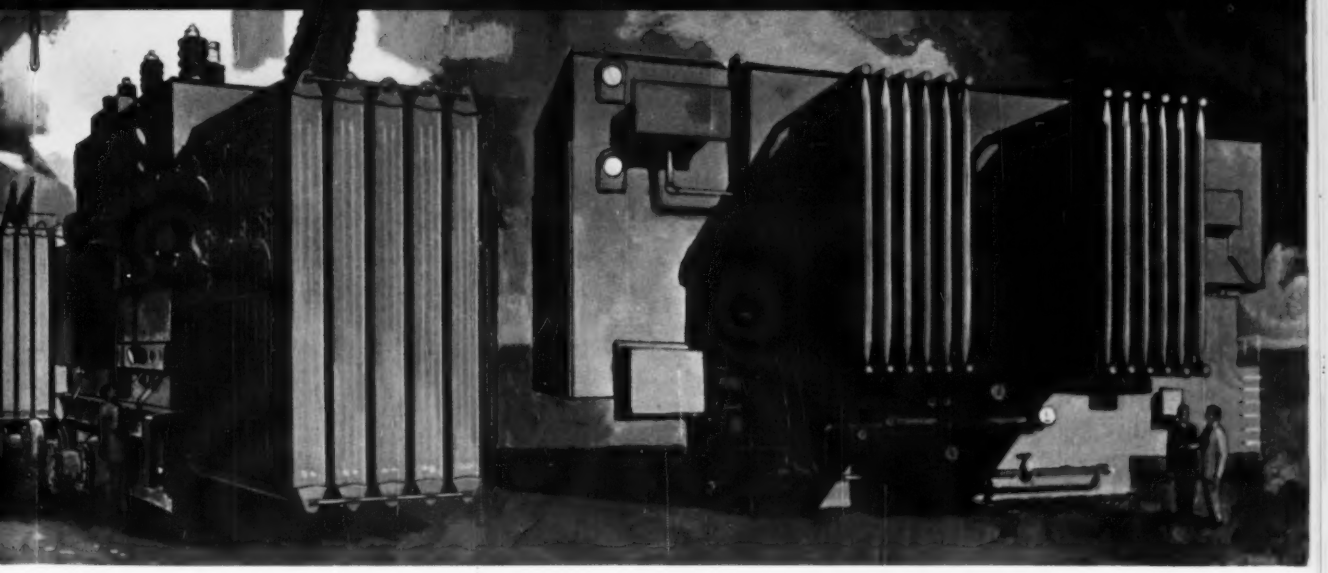
The Tidd and Leadville projects and other studies are the building blocks of EHV knowledge, making possible the design and application of the transmission equipment in your future.

Inner-Cooled transformers . . . reduced size and weight

Inner Cooling makes maximum use of oil as coolant and cellulose material as insulation, drastically reducing core and coil size. The significance of this design lies in two major areas. First, Inner Cooling now enables Westinghouse to build and ship transformers of

for your future system

Determination and resourcefulness to design the industry's most advanced line of apparatus . . . New Westinghouse products answer problems and objectives confronting the electric utility industry. At 200 research and design centers across Westinghouse, the industry's most concerted and interrelated effort to meet these objectives is continuing.



enormous capacity. The world's first transformer with Inner-Cooled construction was recently installed at New York State Electric & Gas Company, weighing only 3.1 pounds per kva. On higher voltage designs, weight has been brought down to 1 pound per kva.

Second, operating cost per kva is now lower than ever before. Performance has improved, permitting reduction of impedances and losses.

These compelling reasons commend the Inner-Cooled Westinghouse design for the transformer of the future.

Vapor-cooled transformers . . . combine dry-type safety with liquid-filled capacity and insulation level

Vapor-cooled, vapor gas-insulated transformers are another major breakthrough in Westinghouse power transformer design. This technique uses fluorocarbons to transfer heat . . . as a vaporizable liquid for cooling and as a high-dielectric gas to insure proper insulation strength. Two such transformers—the world's first, at Baltimore Gas & Electric Company and Consolidated Edison Company—are now in service and promise to be the ultimate answer in congested areas. They're nontoxic, nonexplosive, fireproof, thermally stable; in brief—they are safer.

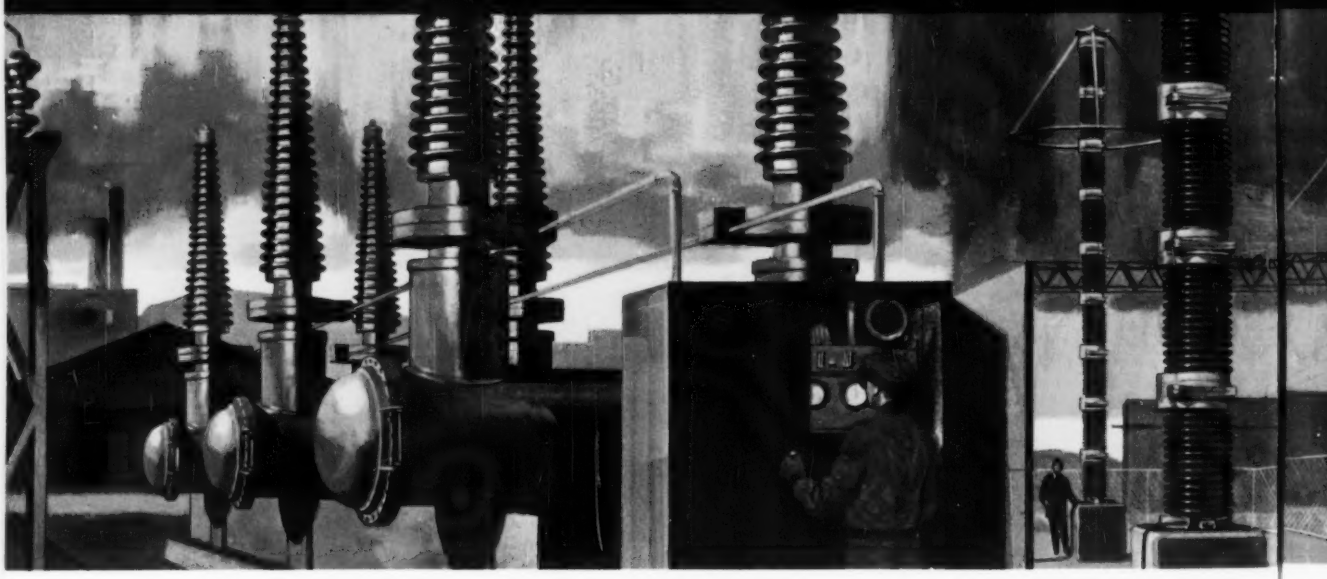
This transmission equipment can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

YOU CAN BE SURE...IF IT'S **Westinghouse**

WESTINGHOUSE

is ready today to build products

to distribute power



Westinghouse is ready now to build 690-kv power breakers . . . SF_6 Gas is breakthrough to conquest of the industry's costliest arc extinguishing problems

Sulfur Hexafluoride—SF_6 Gas—is the interrupting medium for a 230-kv, 15 million-kva power circuit breaker now being built for Pennsylvania Power and Light Company. What are the limits to capacity of the SF_6 breaker principles? There are none.

Capacity is only one measure of the most significant breaker design advance in over 15 years. Safety? SF_6 is inert, nontoxic, odorless, nonflammable; breaker is dead tank construction. Maintenance? Drastically cut; arcs are extinguished without gas deterioration. Weight? Reduced up to 65 percent over comparable oil breaker ratings; foundations can be simplified. Quiet? Comparable to oil breakers; ideally suited for those substations in high load density residential areas.

Here is one more example of how Westinghouse has spent millions in product designs to save utilities tens of millions in future construction and operation.

Westinghouse is ready now to build lightning arresters at and above 690 kv

The idea of a nationwide transmission grid highlights two needs immediately . . . extra-high voltage transmission and standards of reliability never before achieved. EHV will be required to move large blocks of power economically. But, a basic problem in EHV reliability has been lightning outage. Application of a completely new theory of lightning stroke now promises to reduce lightning flashover by three to one. Effects of lightning on different designs of transmission

for your future system

Capability to produce the industry's most complete line of reliable apparatus . . . With utility industry progress at a dead run, a responsible manufacturer can do nothing less than provide equipment as operationally perfect as manufacturing science can produce. Westinghouse ability to continue to meet this challenge is evidenced by facilities being built and modernized throughout the company at the rate of 70 million dollars a year.

line can now be predicted with far greater accuracy. Increased line reliability must be matched by improved protection of equipment. Westinghouse is ready now to build arresters to meet the obligation of reliable, economical transmission . . . to 690 kv.

You can reduce distribution investment 25% by doubling secondary voltages

Apparatus investment in distribution systems is well over a billion dollars annually. An opportunity to save hundreds of millions of such an amount can scarcely be overlooked.

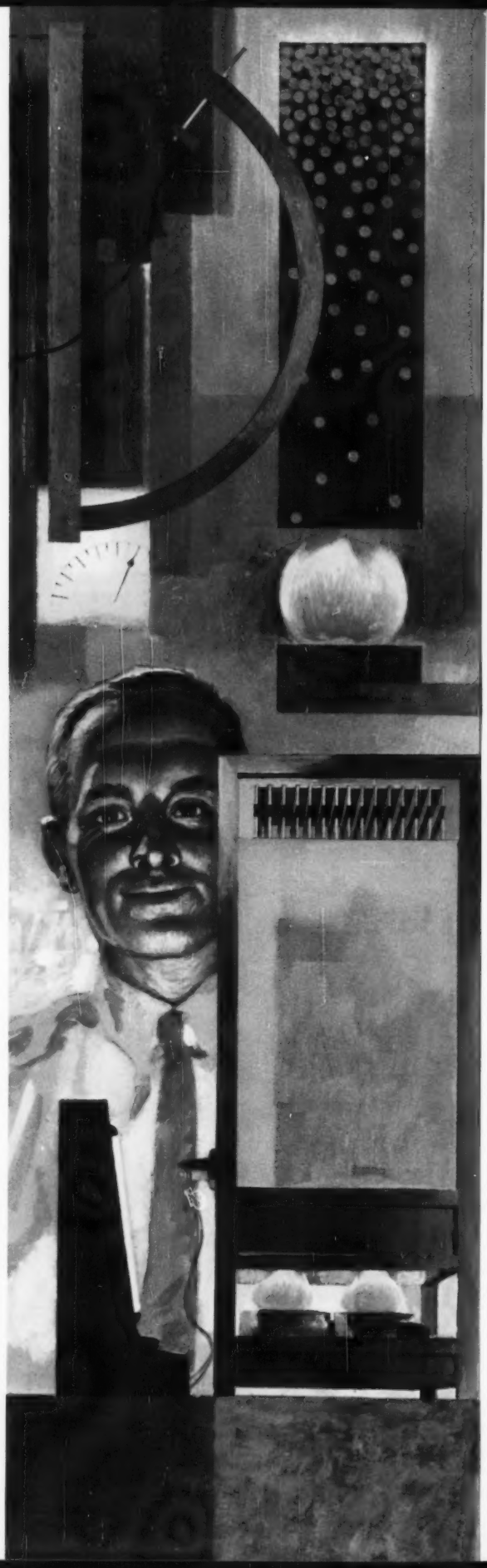
For example, in a high-use residential area, a 37½-kva transformer may serve four homes. In new housing developments, by changing over to 240 480-volt service, one transformer can do the work of four or five. With higher secondary voltages, primary voltages may be raised to 25 kv or even higher. This eliminates present intermediate voltage levels and need for substation transformation.

Average industry installation costs and capitalization rates indicate higher secondary voltage systems will save substantially through the years over present conventional systems.

Westinghouse is ready now to build pole-type transformers at 333 kva for commercial loads.
This equipment of the future can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

YOU CAN BE SURE...IF IT'S **Westinghouse**

This experimental Westinghouse thermoelectric generator produces electric power by the direct conversion of heat into electricity. Work is progressing on this and similar advances—keys to the future beyond the developments discussed on the preceding pages.



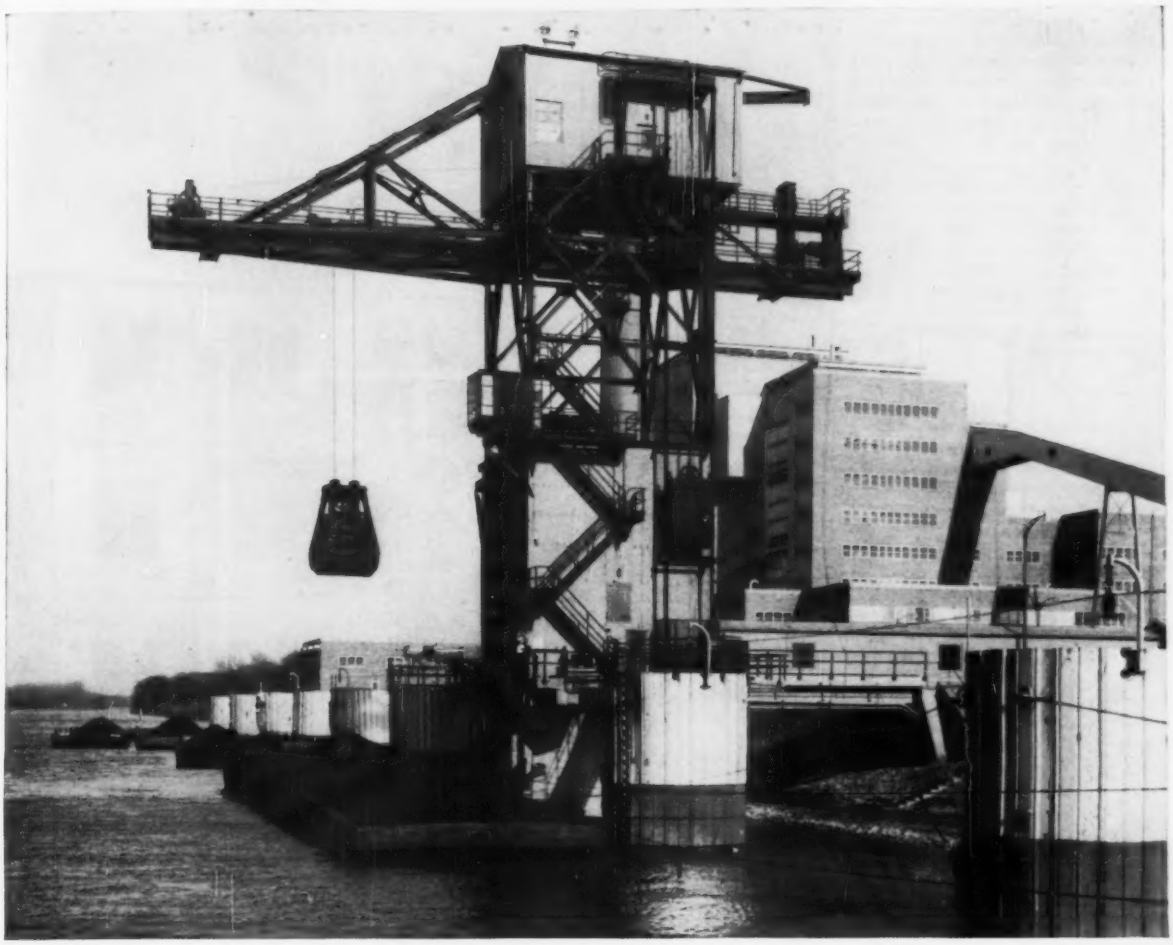
there's time to plan but none to waste

The products shown on the preceding pages will be component parts of the power system of the 1960's . . . your system. The need for these products, so evident today, was discernible many years ago. Westinghouse marshaled foresight, talent and capital to develop them. Westinghouse presents them to you with the conviction that their place on your system should be recognized now, be planned for today.

Get in touch today with your Westinghouse representative. He can bring to bear on your system development program the talent and facilities of all of Westinghouse. CP-1051

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH WESTINGHOUSE LUCILLE BALL DESI ARNAZ SHOWS CBS TV



At Illinois Power Co.'s Hennepin Station:

Dravo-built coal unloader to handle 4 times original plant capacity without modification

As the Illinois Power Company quadruples the capacity of its Hennepin Station, on the Illinois River, the rewards of proper long-range planning are apparent.

Because the company, and its consulting engineers, Sargent & Lundy, planned for the future six years ago, the greatly enlarged capacity is being accomplished without need for new unloading equipment or for modification of the present Dravo coal unloader.

When the Hennepin Station was first built, it housed only a single generating unit. However, Illinois Power anticipated its load growth, and at that time installed a Dravo coal unloader large enough to handle a second unit.

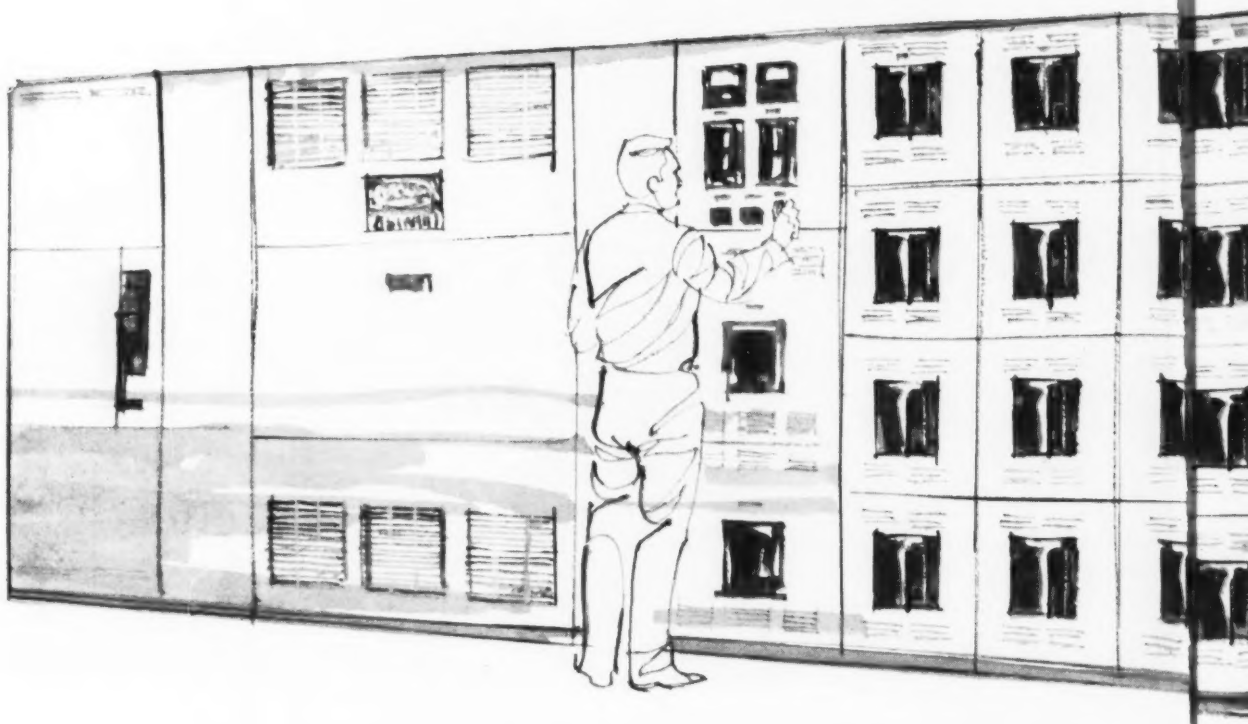
The full production of the unloader could not be used with the single unit, but now that an additional 225,000 kw unit has been placed in operation, the Dravo unloader is of sufficient capacity to handle the entire production.

Whether you must build for tomorrow's requirements, or to meet the pressing needs of today, Dravo's broad experience in coal unloading equipment can help make your investment more profitable.

Complete information on this important area of utility operation is readily available. Contact Crane and Bridge Department, DRAVO CORPORATION, PITTSBURGH 25, PA.

DRAVO
CORPORATION

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders • dredging • fabricated piping foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges • process equipment • pumphouses and intakes • river sand and gravel • sintering plants • slopes, shafts, tunnels • space heaters • steel grating • towboats, barges, river transportation

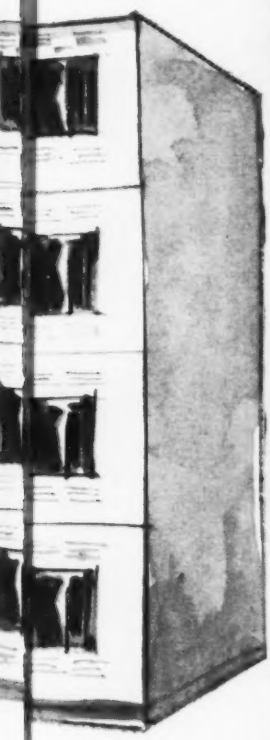


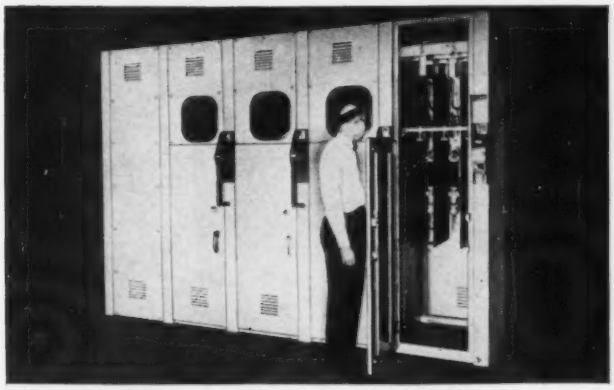
AHEAD

An I-T-E Secondary Unit Substation is more than just a source of power for your central station requirements. It's an investment that puts you years ahead in station equipment.

The new I-T-E K-LINE circuit breakers are unmatched for safety, protection and lasting economy. Manual quick-make, extended range trip adjustment, and closed-door disconnect are all combined in a single, compact design. The transformer is built by I-T-E for your own particular application on a basis of fresh engineering ideas original with I-T-E. The I-T-E primary fused interrupter switch or metal-clad circuit breaker closes even into a fault with complete safety for the operator, and the entire substation is assembled and shipped from a single plant . . . you are assured complete coordination, easy assembly, and on-time delivery.

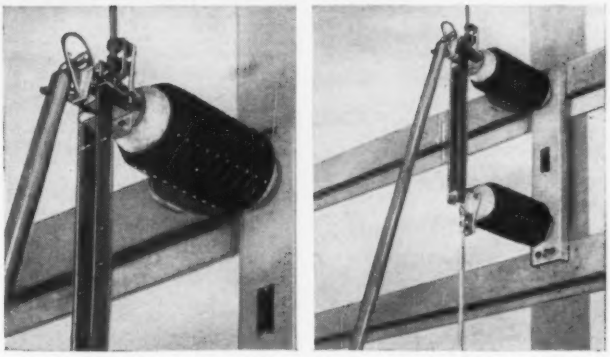
If you want to be ahead in the equipment you buy, look into the broad I-T-E line. Users claim you can't buy better, yet it costs no more.





Safe switching. Yes, there's real economy in fused power switching centers, but make sure you also get the *extra safety* only I-T-E offers. In every I-T-E Power Switching Center, you have the assurance of knowing that switches can be closed *even into a fault* with complete safety for both personnel and equipment. Unique standardized cubicles and building block construction reduce engineering expense (the saving is passed on to you), and also shorten the time between order and delivery. Equipment arrives on the job in sturdy, preassembled units, ready for easy, fast installation.

Disconnect circuit breakers with door closed. I-T-E low-voltage metal-enclosed switchgear gives new operator safety. K-LINE circuit breakers can be moved from connected, through test, all the way to disconnected position without opening door. Overload setting easily adjusted to new load conditions by expanded calibration overcurrent trip device. Manual quick-make affords safer operation and extends contact life. Compact construction permits 4-high mounting of circuit breakers of up to 600 amp rating. K-LINE ratings: 600 v a-c, 250 v d-c, 15-1600 amp continuous.



Hear it snap shut. New I-T-E hook-operated disconnecting switches provide positive indication that they have closed completely. An easily audible "snap" is heard. And extra-large latch members serve as visual assurance. Parallel blades are widely spaced and heavily braced for maximum rigidity. Roomy hook-stick eye and pryout motion in opening contribute to the easy operation of the switch. Ratings: 7.5 through 69 kv, 600 and 1200 amp.

U-3

I-T-E CIRCUIT BREAKER COMPANY
1900 Hamilton St., Philadelphia 30, Pa.

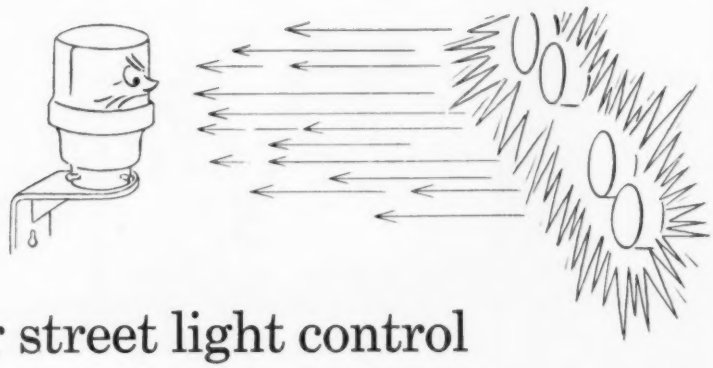
- ☐ Secondary unit substations
- ☐ Power switching centers
- ☐ K-LINE circuit breakers
- ☐ Hook-operated disconnect switches
- ☐ Isolated phase bus
- ☐ Metal-clad switchgear (4.16 and 13.8 kv)
- ☐ Reclosers
- ☐ Primary unit substations
- ☐ Other .....

Name ..... Title .....
Company .....
Street .....
City ..... Zone .... State .....

SEND COUPON OR WRITE

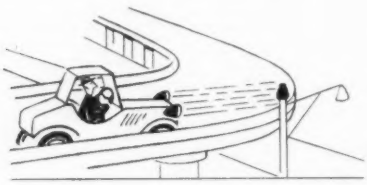
Get complete, up-to-date information on I-T-E equipment.

I-T-E CIRCUIT BREAKER COMPANY



When your street light control sits right in the path of somebody's headlights..

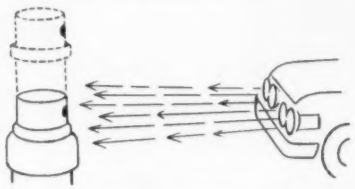
. . . the photoelectric control may switch and turn off the streetlight — IF the headlights are bright enough, come close enough and the control looks them straight in the eye.



In the majority of cases, though, this problem never comes up because the control sits 30 feet in the air, well above the confusion of headlights. But in those rare instances where it *might* happen, here's why there's no cause for alarm.

With Fisher-Pierce photoelectric controls, the key to the problem of bright transients lies in their distinct *directional* nature. It so happens that this is one of the reasons we make our controls directional — so they *can* look away from the source of confusion. And that is also one of the answers: turn the control around a little so its photosensitive element doesn't get the full, four-light, high-beam benefit of Detroit's latest creations.

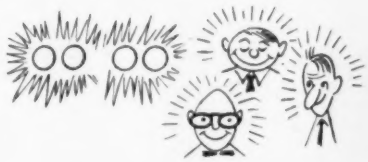
Solution #2 depends on the "flat top" characteristic of most headlight beams, and is practically as easy as number 1: raise the control just enough to put it a whisker above the beams. In some cases this may turn out to be only a foot or so.



Some control installations (e.g., on luminaires) won't permit any change in the height of the control, so re-orientation is the answer. And when you depart from the generally northward orientation of F-P controls, you've got 90° to play with between NW and NE.

We know this works because we tried it, and the only surprises were how little re-orientation or height-changing did the trick. The automobiles used had four good bright headlights apiece, the controls were 6600A types, and just to get an idea of the light levels involved we made readings at the control with an illumination meter. When the car got within about 50 to 60 feet of the control, coming head on with the control at the exact level of the headlights, the control saw enough light to turn off. But in every case, either re-orienting or elevating the control prevented turn-off. We even tried it with the headlights only 10 feet away — which put 160 foot-candles on the control — and 12 inches of control-raising stopped the turn-off.

That's our story on the headlight problem, put in print because it does concern some people. We've never heard of a situation that can't be remedied by one method or the other. But if you run into one, we'd like to hear about it and help if we can. These new headlights are bright, all right —



but we think the people who put up the controls are a lot brighter. The Fisher-Pierce Co., 82 Pearl Street, So. Braintree 85, Massachusetts.

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

"The right technique *plus* the right tools are what it takes to get the most out of any investment in wood," says a good hobbyist friend of ours.

Many industrial wood users share this viewpoint. It's one of the major reasons they give for consistently specifying AMCRECO pressure-treated products.

Take the preservation method. Service records – some going back over 50 years – show that AMCRECO pressure treatment provides the longest, most dependable wood protection. Added to this is a big plant modernization and expansion program which totals nearly one million dollars... new, improved facilities that help insure fast service to all AMCRECO customers.

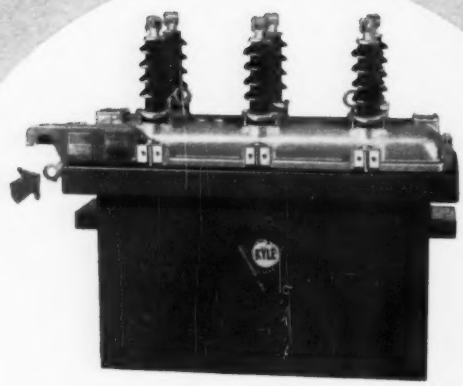
Why not consider this unusual combination of experience and equipment before you place that next order?

AMERICAN CREOSOTING CORPORATION

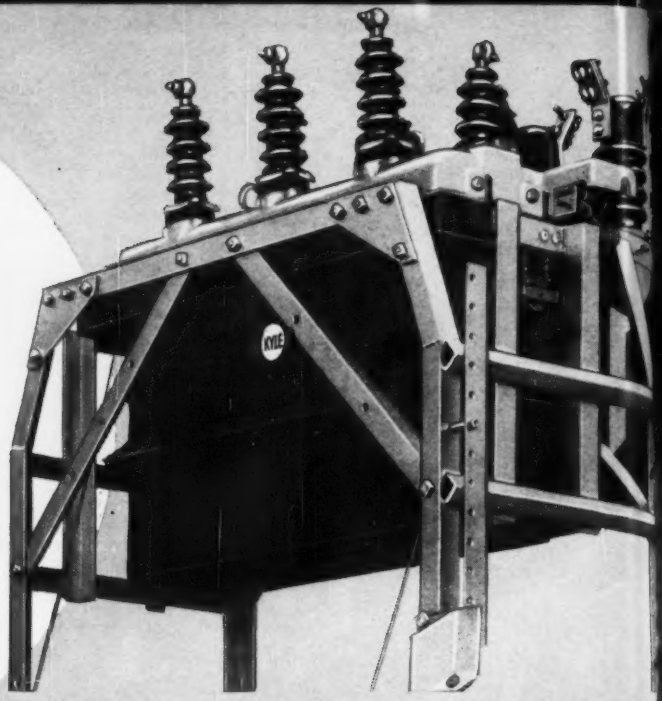
AMCRECO
PRESSURE TREATED WOOD PRODUCTS

Louisville 2, Kentucky

Subsidiary of Union Bag-Camp Paper Corporation



KYLE TYPE R heavy-duty 3-phase recloser. Available in 12 current ratings from 25 to 400 amperes, 2.4 to 14.4 kv. Interrupting ratings up to 6,000 amperes at 4.8 kv. Note that the trip-free operating lever functions both for manual opening and manual closing. Further, this lever is a lockout position indicator when in the down position.



KYLE TYPE W heavy-duty 3-phase recloser is rated from 100 to 560 amperes, 2.4 to 14.4 kv; interrupts up to 12,000 amperes at 4.8 kv, 8,000 at 14.4. Can be unbolted from mounting frame easily with common wrenches; no wrench extensions or unusual tools required.

Kyle Types R and W Heavy-Duty Reclosers Offer Unmatched Features and Operation

Dial your operating sequence! Finger-tip, positive, pretested indexed positions for: (1) timing; (2) operating sequence; (3) number of operations to lockout.

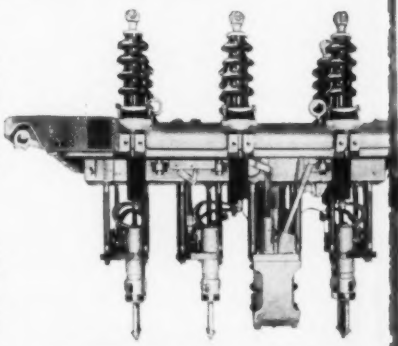
With more extensive recloser engineering and field experience than any other manufacturer, Kyle has produced in the heavy-duty Types R and W reclosers, apparatus that is completely unmatched by any similar products now available.

Kyle reclosers offer many advantages in operation that make coordination easier and more exact; reduce burndowns; and thus improve service continuity.

The Kyle operating mechanism is readily accessible. Contacts are visible and may be inspected when open. Coils may be changed in the field. The number of fast curves may be selected and changed simply by turning a dial. Two retarded curves are precalibrated at the factory, so no "cut and try" adjustments involving expensive testing time are needed if the user desires to change from one retarded curve to the other. Every Kyle Type R and W is completely and accurately factory precalibrated on all of its time-current characteristics, not just the single characteristic specified on the order. Actually, every R and W has over a hundred factory timing-test operations.

Let Us Supply Bulletins

These are some of the many superior design and operating features that make the Kyle Types R and W the best reclosers on the market. Ask the L-M Field Engineer for complete information. A large library of literature is available—on application, operation, and maintenance. He will be glad to supply whatever you can use. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



MECHANISM WITH TANK LOWERED. With the Kyle unit, the recloser frame can raise or lower the entire recloser, or lower the tank only, for inspection or maintenance. Kyle reclosers are completely self-contained; no additional external power source is required to operate them.

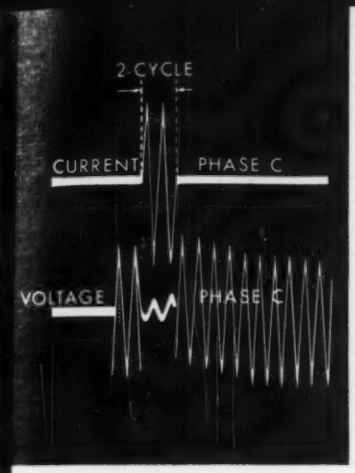
LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

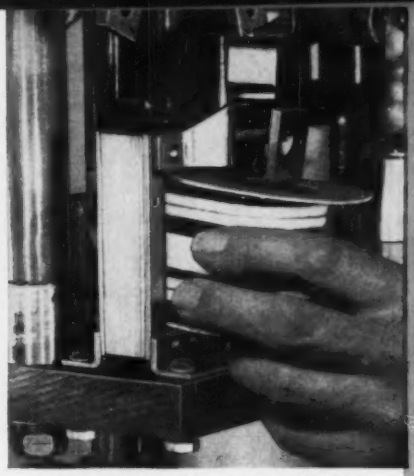
Kyle® Switchgear

McGRAW EDISON

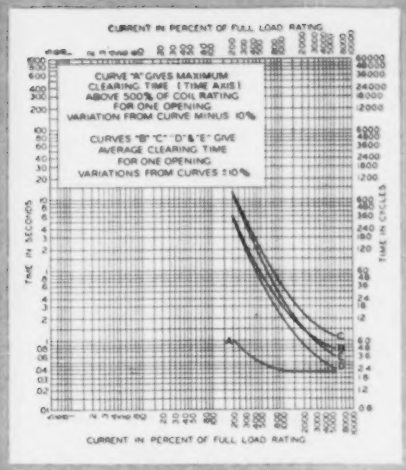
DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



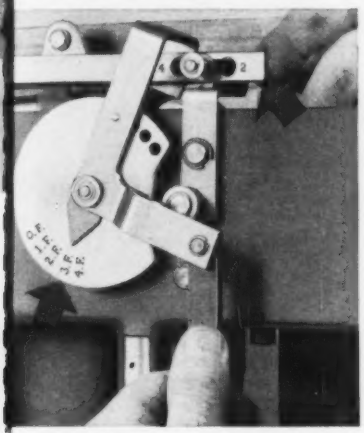
OSCILLOGRAM shows typical example of current interruption. *Maximum* clearing time over most of fault current range for the Type R is 2 cycles; 2½ cycles for the W. This is total, starting at the instant the fault occurs, and includes sensing, operation, and final arc quenching.



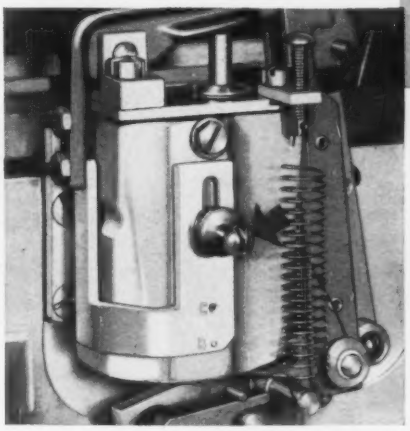
CHANGING THE SERIES TRIP SOLENOID, which determines the tripping current, is easily done in the field. Both reclosers are available in a wide range of tripping currents, affording a wide degree of application and permitting proper feeder protection as the load changes.


CURRENT IN PERCENT OF FULL LOAD RATING
CURVE "A" GIVES MAXIMUM CLEARING TIME (TIME AXIS) ABOVE 500% OF COIL RATING FOR ONE OPENING VARIATION FROM CURVE MINUS 10%
CURVES "B" "C" "D" & "E" GIVE AVERAGE CLEARING TIME FOR ONE OPENING VARIATIONS FROM CURVES ±10%
TIME IN SECONDS
TIME IN CYCLES
CURRENT IN PERCENT OF FULL LOAD RATING

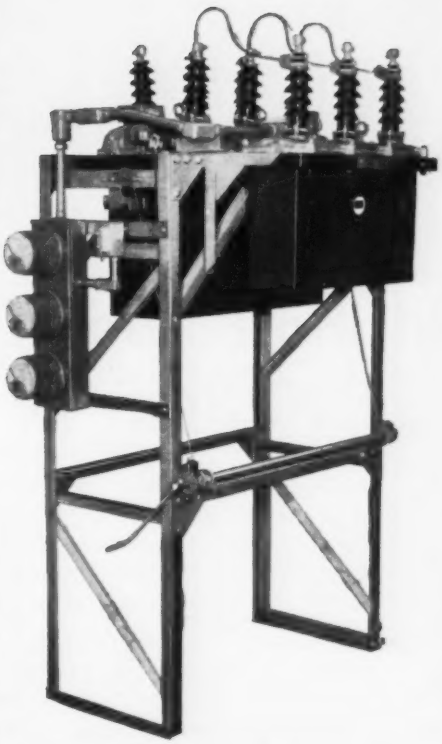
CHOICE OF FIVE CURVES—one fast (instantaneous) and four time-delay curves—is available on phase tripping. Delay curves B and C are obtained with one piston assembly, by simple change shown above. Or, with modification of the piston assembly (not a field operation), the reclosers are available with choice of D or E curves. No "cut and try" adjustment in the field.



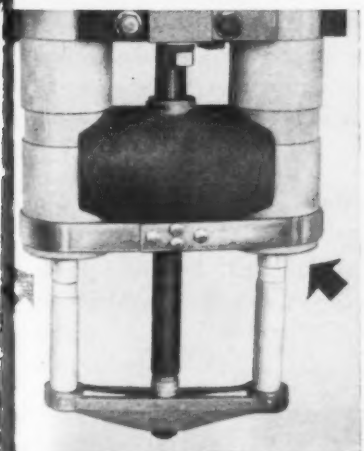
THESE RECLOSERS may be set for 2, 3, or 4 operations to lockout by simply re-indexing the lockout bar. Changing the easily accessible dial permits selection of 0, 1, 2, 3, or 4 fast operations. Any remaining operations to lockout will then be the delayed operations on the B or C curve, whichever is selected.



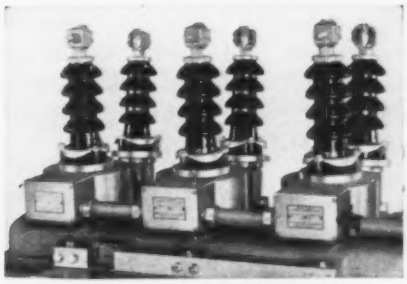
FOR CHOICE OF time-delay curves it is only necessary to loosen this thumb-screw and index the adjustment bracket to the curve desired. Both retarded curves have been test-board-calibrated, and no "cut and try" adjustment is necessary in changing to the other curve.



RIGID SUBSTATION MOUNTING FRAME. Windlass hoists recloser to any desired height without additional equipment. Since entire mechanism is suspended from the head, the recloser frame can raise or lower entire recloser, or lower the tank only, for easy inspection or maintenance.



DOUBLE-BREAK CONTACTS with oil cross-blast arc extinction. In the open position the contact tips are accessible for visual inspection—no disassembling necessary. Contacts cannot fall closed.



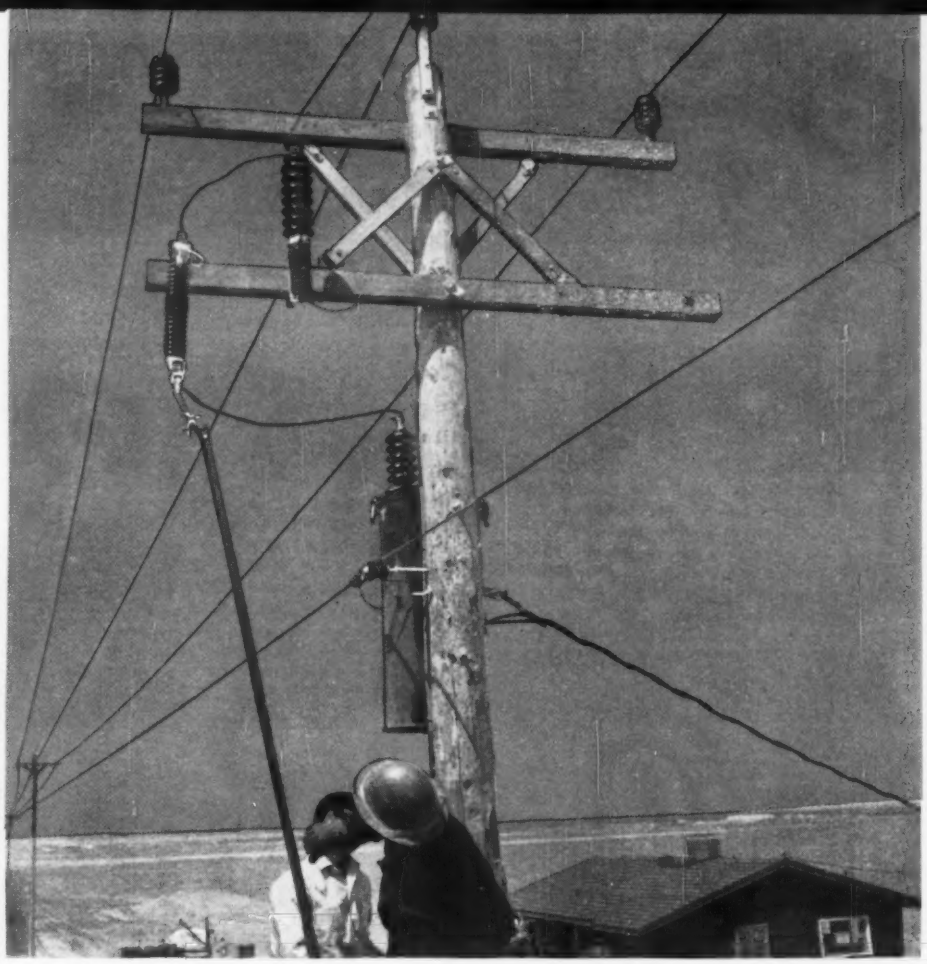
BUSHING CURRENT TRANSFORMERS are available as an accessory. These are mounted on the *outside* of the tank, where terminals are accessible by means of a screw plate. No untanking necessary.

LINE MATERIAL® Industries

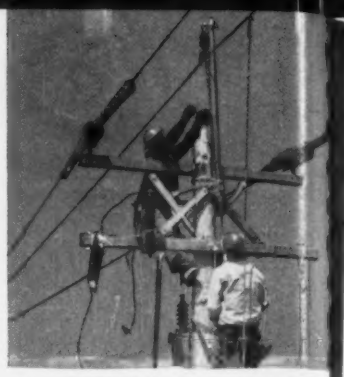
McGRAW-EDISON COMPANY

Kyle® Switchgear

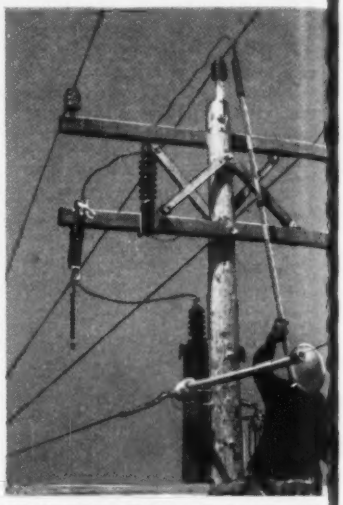
McGRAW EDISON



L-M 27 KV TYPE HDO fuse cutout and Type SS arrester protect this 20 kv Round-Wound transformer.



IT IS PRACTICAL to work 20/34.5 distribution lines hot, when proper saf procedures such as these are follow



WITH JOB COMPLETED, hot line cla are tightened in place prior to remo of protective line hose.

Idaho Power Company Uses L-M Equipme for 20/34.5 kv to 240/120 Volt Service Dro

Idaho Power Company has overcome the problems posed by great distances and low population density, through installation of a three-phase, four wire, 34,500 volt grounded wye distribution line. This system eliminates the need of all subtransmission and has fewer substations, less regulating equipment and higher feeder loading, resulting in lower cost per kva of installed capacity. It has proved most economical in distributing power along the 275 miles of isolated farm land.

L-M has cooperated with progressive Idaho Power through research and development of apparatus and construction materials to make this economical distribution voltage practical. All products for the 150 kv BIL system are available from L-M—switching equipment, porcelain insulators, capacitors, cutouts, lightning arresters, reclosers and Round-Wound® transformers.

Get Complete Information.

L-M offers a compilation of data on the design and operation of 20/34.5 distribution. Ask your L-M field engineer for these papers, or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

Distribution Specialists

McGRAW EDISON

408

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

Editorial Comment

JULY 20, 1959

Senate Would Limit TVA Expansion

The Senate, in passing Tennessee Valley Authority self-bonding legislation, has included specific territorial limitations on TVA's authority to expand. The Senate bill spells out exceptions to the limits, but these exceptions are insignificant. For practical purposes, TVA would be legally contained within a prescribed area, and this has never been accomplished before.

The Senate version of the bonding authority legislation would permit TVA expansion up to five miles beyond the periphery of the territory it supplied on July 1, 1957, and allow new TVA service to eleven specific towns and one naval air facility. But—no state not now served by TVA could receive new TVA service; no single state now supplied could take more than 500 square miles additional TVA area; and total new TVA expansion could not exceed 2,000 square miles.

These limits not only are precise; they do not permit the acquisition by TVA of any significant loads now served by TVA's investor-owned neighbors.

If executive and legislative checks and balances on TVA's financing are not to exist for all practical purposes, there must be fences built to prevent indiscriminate expansion with uncontrolled funds. The Senate has shown itself awake to its responsibility to build such fences. We hope the House will go along.

Low Cost Nuclear Power Versus Modern Steam Turbines

In the evolution of conventional steam plants, experience has proved that the greatest overall plant economies have trended upward hand-in-hand with increasing steam conditions. The sleek, compact, efficient turbine has been one result.

Many utility engineers have not relished the return of the comparatively bulky, low-speed, low-efficiency machine in early nuclear stations. When reactor designers began to find ways to achieve higher steam conditions, these engineers cheered them on.

On the face of it, this sentiment seems well-placed. Probably, for most reactor types, it will prove correct. But the prestige-value of using the most modern steam apparatus could blind us to the fact that, at least in some types of reactor plants, the lowest overall costs might require use of an old-style machine.

Are we after lowest costs, or modern turbines? If we accept the ultimate goal of the whole nuclear power program to be achievement of the lowest overall cost at the earliest date, the turbine must play second fiddle, at least for awhile.

TVA Bond Bill Eases Out of Senate

Dirksen recommends a veto if the bill's mild budgetary controls remain intact after joint conference. Only unchanged feature is $750 million limit on bonded indebtedness

The Senate last week gave an apparently easy birth to the Tennessee Valley Authority's bond-financing bill (HR-3460), although its Public Works Committee earlier had made some changes in the House-passed version.

Now the bill goes to a Senate-House conference to iron out differences, and then it goes to the White House where its fate is anyone's guess. Supporters of the measure feel they've made enough concessions to President Eisenhower's requirements for a bond-financing bill so that he will sign it. Opponents, however, point out that several of Ike's conditions are still missing in HR-3460.

Veto Urged

Senate minority leader Everett Dirksen (R-Ill.) has urged Eisenhower to veto the bill in the form it emerged from either the Senate or House because it provides practically no control over the authority's operations by the Budget Bureau.

"If I were President," said Dirksen, "I'd reach for the biggest blue pencil there was, and say, 'This is not for me.'"

The budgetary provision—or lack of it—has been considered for some time the principal stumbling block for the proposed bill when it reaches the White House.

And a Presidential veto would be final. The House's bill passed by a 245-170 vote, considerably short of the required two-thirds margin to override a veto. There is no indication of what the Senate vote might have been, had it been recorded.

The measure that goes to the White House will be a compromise between the House and Senate versions, and probably a little closer to the Senate's. Senate members of the conference committee are all pro-TVA: Kerr (D-Okla.), Chavez (D-N.M.), Cooper (R-Ky.), Case (R-S.D.) and McNamara (D-Mich.).

The bill had only one feature that went through both sides of Congress unchanged—that is the $750-million total limit on bonded indebtedness for TVA at any one time. Funds from bond issues could be used to construct new power facilities, or for expansion, improvement or acquisition of existing facilities.

DIRKSEN: 'Not for me.'

Other major provisions of the proposed legislation differed between the House and Senate versions, as follows:

Area limitation. The House bill called for a limit to TVA's "service area" within the territory in which it was operating on July 1, 1957. This restriction had been put into the House bill at the request of Rep Carl Vinson (D-Ga.), and was intended to put into writing the 20-year old "gentlemen's agreement" existing between TVA and its neighboring electric utilities. Eight towns were specifically exempt from this limitation, however, and TVA still was permitted to enter into power exchange agreements with utilities with which it had contracts on July 1, 1957.

The Senate version, on the surface, appears to be considerably less strict on TVA. Principally, the Senate would authorize TVA to supply power into an additional 2,000 square miles beyond the territory it was supplying on the 1957 date. In addition, TVA could expand only up to 500 square miles in a single state; could not expand more than five miles outside its 1957 boundaries; and could not serve any states not being served in 1957. And, the Senate also would allow TVA to serve 11 specifically exempt towns and a naval air station outside the authority's boundaries as of the July 1, 1957 date.

However, Sen Kerr insists that the Senate bill would be more of a check on TVA than the House measure, because the House term of "service area" is vague or naive. To him, TVA's service area could be anywhere "within economically feasible distance," or up to 400 miles of a transmission line. He claims there is no such thing as a service area, and the Senate bill really is more definite from a legal standpoint. He adds that the five-mile peripheral expansion, allowed in the Senate bill, is simply to permit "necessary adjustments" in its operations. The total area involved in this five-mile peripheral expansion would come to nearly 25,000 square miles—an impossibility since the bill limits total expansion to 2,000 square miles.

Buy American. The House version specifically ties TVA to provisions of the "Buy American" Act, while the Senate version did not. This act would require TVA to give a 6% (or 12% in labor distress areas) price advantage to domestic equipment suppliers over foreign concerns.

The House-Senate conference undoubtedly will clarify the difference in the two bills, emphasizing that TVA is to stay under the "Buy American" Act. Kerr agreed on the Senate floor to replace the House wording, deleted in the Senate version, if that was necessary to keep TVA under the Act. He said he thought the authority would be under the Act's jurisdiction, regardless of whether it was mentioned in the bill, and had left out the House provision solely on that basis.

Budgetary control. Neither the House nor the Senate versions give any control to the President or the Budget Bureau to originate financing plans for TVA each year. In the Senate bill, TVA's bond-financing budget is made part of the annual federal budget, but the President only can comment on the program drawn up by TVA directors.

Congressional control. Both versions give Congress a 90-day period in which to pass a resolution against TVA's plans for a specific bond issue; otherwise, the authority's plans cannot be halted. The Senate version would begin this period each year with the budget message.

Treasury Department control. The U. S. Treasury has almost no authority over TVA's bond financing operations in either version. The House bill gives the Treasury Secretary up to 15 days to consider a proposed bond issue, plus an additional total of 75 days, if he objects to it and suggests revisions. After that time, however, TVA is free to continue with its original plans.

The Senate version gives Treasury up to eight months to defer a proposed bond issue, but this is limited to authority on only the proposed time of issue and amount of interest involved. And during that eight-month period, Treasury would be required to accept up to $150-million in interim, one-year notes.

Repayment of appropriated debt. Neither bill would require complete or prompt re-payment of federal appropriations by TVA. The House bill calls for entire repayment (about $1.2-billion), at the rate of $10-million annually, stretching repayment out for at least 120 years. The Senate version calls for a $10-million minimum repayment for five years, $15-million repayment the next five and $20-million annual payments until $1-billion is paid.

Accounting requirements. The Senate bill, also from a few changes, would leave TVA under the provisions of the Government Corporation Control Act, while the House version completely exempts TVA. Basically, this act gives the Treasury control over TVA checking accounts, government investments.

Turbine Generator Prices Cut

GE sets the pace, Westinghouse and Allis-Chalmers expected to follow. But industry sees no price war resulting

A small army of General Electric Co sales representatives set out a week ago last Friday calling on top officials of electric utilities. Their mission: Announcement of a $1-to-$4 per kw cut on steam turbine generators of 200 Mw and up.

Shortly thereafter, GE said it was also reducing prices by 15% on mechanical drive turbines, the types used by the chemical and petroleum industries, in 4,000 to 10,000-hp sizes.

The announcements touched off a wave of speculation as to whether these adjustments signalled a major softening of apparatus prices. The general consensus, however, was that GE's action wasn't precipitating price cutting bouts among the manufacturers.

When Westinghouse Electric Corp, Allis-Chalmers Mfg Co and Worthington Corp were asked about price plans, they replied that adjustments were coming to keep their prices competitive.

Escalation Clause Altered

The GE cuts were also accompanied by a modified contract price adjustment clause. The reworded clause waives the first 2.5% increase in prices resulting from present Bureau of Labor Statistics formula each year during the life of each sales contract.

The same clause applies to the whole line of power generating equipment as well as to combustion gas turbines and gas turbine generators. It, in effect, reduces contract ceilings for nearly all ratings of these items for shipments within two to four years.

GE said the changes are the result of engineering design innovations on the large units and improvements in manufacturing techniques. The company recently completed installation of automated tools operated by a computer at its large steam turbine generator department in Schenectady, N. Y. (EW, June 29, p 118).

Here's how the reductions are handled in GE's new price schedule:

One dollar a kw on 200,000-kw units; $1.50 a kw on 250,000-kw units; $2 a kw on 300,000-kw units; $2.50 a kw on 350,000-kw units; $3 a kw on 400,000-kw units; $3.25 a kw on 450,000-kw units; $3.50 a kw on 500,000-kw units; and $4 a kw on 600,000-kw units.

The reduction on small turbines was pegged to the use of "building block" components, which are reducing engineering and manufacturing time at GE's Fitchburg, Mass., small steam turbine department plant.

Besides the link to plant efficiency, the cuts were also seen as a move to boost business volume at a time when new orders have lagged. In his first half earnings report, Ralph Cordiner, chairman and chief executive officer, said that heavy electric equipment shipments continued to drop during the first six months of 1959. He added, however, that "In recent weeks there has been an increase in orders and customer inquiries."

Price War Idea Scorned

Several utility industry sources said they did not think any inference of a "white sale" or "price war" being on the way could possibly be drawn from GE's cut or other manufacturers' plans.

One purchasing executive called the developments "a move in the right way, particularly on heavy equipment. While it's a sizeable reduction," he continued, "it doesn't portend a 'white sale' in my opinion."

A director of purchasing said GE's action was "no news to us." He believes the cut was an attempt to get prices back in line, an attempt he's expected since turbine generator prices "took off" during 1956-57.

Some idea of the savings now available on big units is shown below. On a 400-Mw unit for TVA GE recently bid the equivalent of $30 per kw; under the new schedule this would have dropped $3 per kw,

or 10%. On a 600-Mw machine, the bid also was $30 per kw; the reduction would have been $4, or 13.3%.

As for the timing of the first announcement, C. A. Lilly, Jr, manager of marketing, large steam turbine generating department, said that sufficient information has just developed on which GE can compute possible decreases. Only recently, for example, have they shipped the first large machines using new designs and manufacturing techniques, and several more units are in the shops, he said.

The GE cut and planned reductions of Westinghouse and Allis-Chalmers would "stabilize the market", in the opinion of A. C. Monteith, Westinghouse vice president. "It is not a white sale," he declared.

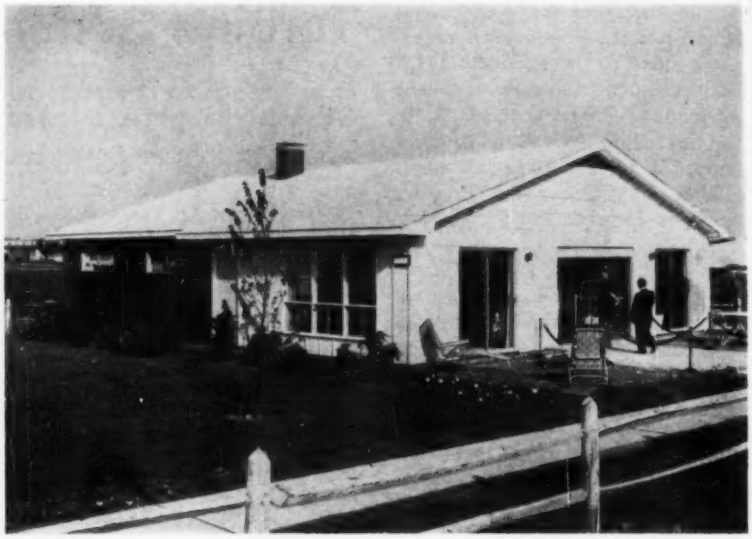
He predicted the GE decreases would go "a long way" toward correcting an "unsound price structure" in unit sizes above 200 Mw. Until now, these larger units were priced at virtually the same amount per kw regardless of size, Monteith said. The change more accurately reflects the manufacturing economies of the bigger machines, he stated.

Price Flexibility Seen

GE's Lilly noted that the price changes on the steam units dealt with machines outside the range of the bulk of imported units.

His point was underscored by the latest development at Florida Power & Light Co, the first private utility to call for foreign bids on big steam turbine generators. FP&L last week named Ebasco Services, Inc, as contractor for installation of a 300-Mw unit, and simultaneously announced that the machine "is larger than any that the foreign concerns could deliver" by a May 1, 1962 deadline. Amount of the Ebasco contract and name of the equipment supplier were not revealed. Originally FP&L called for bids on a 240-Mw unit. Later the utility determined that load growth prospects called for a bigger turbine generator.

Finally, Lilly said that he would hope that the new price schedules would not have to be increased for some time, and that even a "moderate" steel price increase which could follow a steel wage settlement and would not make an upward readjustment necessary.



Moscow Exhibition Home Gets Medallion

Russians visiting the U. S. exhibition opening in Moscow this week will be able to tour a Bronze Medallion Home . . . a home, moreover, well within the reach of the average American worker (above).

The "Splitnik," as the home has come to be known because of a corridor which splits it in half, would sell in the U. S. for $11,000 to $13,000, depending upon the location. It received the medallion for excellence in wiring, lighting and appliances. One of its main attractions is an all-electric kitchen.

In a recent ceremony at Roosevelt Field, Long Island, N. Y., a house identical to "Splitnik" and built by the same firm, was awarded a bronze medallion. The builder, Herbert L. Sadkin (center, below) received the medallion from EEI Vice President and Managing Director Edwin Vennard (right) as Long Island Lighting Co Pres John J. Tuohy looked on. Sadkin, now in Moscow for the exhibition, was given another medallion for the home there.

Vennard, in his presentation, remarked that more than half the families in America can afford "Splitnik." Government statistics show that the average American workman purchases a $14,207 home and pays for it out of his $6,092-to-$6,803 average salary with $96-a-month payments.

FPC Rules Out Evidence on ECAP Series

The Federal Power Commission on Wednesday dealt a damaging blow to the investor-owned utilities' Electric Companies Advertising Program (ECAP).

It ruled that 76 electric companies could not place evidence in an FPC hearing to show that their contributions to a 1957 ECAP series were properly charged off as operating expenses.

The commission—by a 5-0 vote—went far beyond the technical ruling on admissability of evidence. It pointed out also that it was convinced, from testimony so far, that all the ads in question, with one exception, were political in nature and should be paid for out of surplus funds—after taxes. That conclusion would prevent utilities from making the cost of such ads an expense for rate-making purposes.

"With one exception," said the FPC, "the nine questioned advertisements appear on their face to have a direct relationship to political matters. In our judgement, the evidence thus far proffered in these proceedings is without probative value to show the contrary with respect to any of these advertisements. Moreover . . . the contention of certain of the companies that the proffered evidence (that the ads should be normal business expenses) . . . is without weight to prove that these advertisements are in fact non-political."

This ruling sends the case back to FPC Presiding Examiner Edward B. Marsh for a full hearing on whether the nine questioned ads are political in nature, and therefore, whether they should be charged properly against profits under FPC Accounting Category 538. An appeal on the commission's ruling apparently can't be made until hearings are completed.

The FPC staff challenged the companies' accounting of ECAP ad contributions last year, and on Aug. 1, 1958, the FPC instituted an investigation into the matter. These ads were political, the staff charged, and under FPC regulations, they should be paid for out of surplus funds, not from the rate base.

A. J. G. Priest, attorney for most of the companies, had insisted that the political nature of the ads was immaterial to how the ads were handled. If it could be shown, he said, that contributions to the ads were prompted as reasonable business expenses, then the FPC should permit them to be accounted for in the 700 or 800 series without any determination as to whether they were political.

This ground has been wiped out by the commission, and now the companies must defend their position on their opponents' territory—on grounds that will be harder, if not impossible, to defend. That is, to prove that the ads were not "political" under FPC definition. In fact, the commission's added language to the effect that it was convinced that the ads were political, therefore, takes on added significance.

Priest told the commission in an oral argument earlier this year that the companies must be permitted to justify their contributions as business expenses; and for the FPC to prohibit this would be "unjustly discriminatory," a limitation on their free speech and beyond the commission's authority (EW, March 9, p 54).

The FPC staff, on the other hand, has insisted that the only issue to consider is whether the ads are political in nature. The hearings have been in recess since January this year, pending a ruling from the full commission as to what evidence would be accepted.

Contributions to the ads totaled $863,130, according to the FPC. If the FPC staff wins the case, this money would have to be repaid from company profits.

The commission knocked down several specific arguments by the companies, as follows: **1.** The FPC does have authority to place the contributions in Category 538 under terms of accounting interpretation F-110, issued in November 1945. **2.** Prohibition of the companies' right to justify contributions as business expenses is not a violation of the first amendment—they are still free to make contributions; **3.** The "Cammarano" beer and wine case, decided in February, 1959, by the U. S. Supreme Court, does have a bearing on the FPC hearings. In that case, a Washington state wine dealer sought in vain to deduct contributions to a statewide publicity group against a proposed state initiative measure for the state to handle sales.

Powerscope

Steel Test Begins

A goal of improved steel for nuclear power reactors has been set by General Electric Co and U. S. Steel Corp for a recently launched joint study program. Superior corrosion and radiation resistance will be sought in tests at the GETR at Vallecitos. Effects of high-intensity neutron irradiation on pressure-vessel steels also will be studied. The companies hope that the program will provide new steels that will help reduce capital and operating costs of atomic power plants.

Tampa Rates Upped Again

The Florida Railroad & Public Utilities Commission, candidly admitting it made a mistake last year, has authorized an additional $1,585,000 a year rate increase for Tampa Electric Co effective Aug. 1. A 1958 boost of $1,610,000 brought the company's rate of return up to only 5.81% instead of the 6.74% to which it is entitled, the commission said. The latest increase will up the return to 6.5%.

UG Costs Shared

Illinois Power Co has offered to pay the equivalent of overhead construction costs for housing developers who wish to install lines underground. Previously, developers handled all costs of UG installation.

New Gains Displayed By French

Exhibit's air-blast breakers, transformer design and 'bulb' generators excite interest

LATEST WARES of electrical equipment and utility industries impressed IEC visitors. Electrical manufacturers' output now is at $1.83 billion rate

J. H. M. SYKES, Special Correspondent, London

Over 500 organizations took part recently in what has been called the largest electrical exhibition ever held. The newly opened Centre National des Industries et des Techniques in Paris was filled with full-scale items ranging from a complete pole of a 525-kv air-blast breaker to a 100-ton transformer.

French gains in the transformer field were shown by the Savoisenne firm's two transformers, each for 20 Mva, 63/16.5 Mw, with on-load tapchanging. One built in 1952 weighed 73 tons, including an oil content of 20.5 tons, and the other, a 1959 model, weighed 26 tons, with 5.3 tons of oil.

In the switchgear field, Compagnie Electro-Mécanique (CEM) displayed their suspended type air-blast circuit breakers for 250 kv, 5,000 Mva. Each single pole breaker is suspended from the concrete A-frame of the high voltage substation, this frame also serving as support from the substation cross-conductors and, if required, for the incoming line terminations. The breakers have four interrupters per pole. There are two spherical air reservoirs mounted one above the other and separated by insulators for full line voltage. Two interrupters are mounted on each reservoir, all being connected in series. Air supply is carried through a chain of rod-type insulators suspended from the lower reservoir, and the control impulses also pass through this channel.

A CEM engineer said that it was felt that the ultimate stage in design had been reached on air-blast interrupter elements. The need now, he stated, was to devise new mounting and connection methods to economize in substation area and decrease installation costs.

Russia Gets 4.78% of Imports

France's electrical manufacturers sent 4.78% of their exports to Russia last year compared with 2.11% to the U. S. and 1.36% to Britain. On the other hand she imported nothing from Russia while the U. S. topped the import list of electrical equipment with 30.8% of the total.

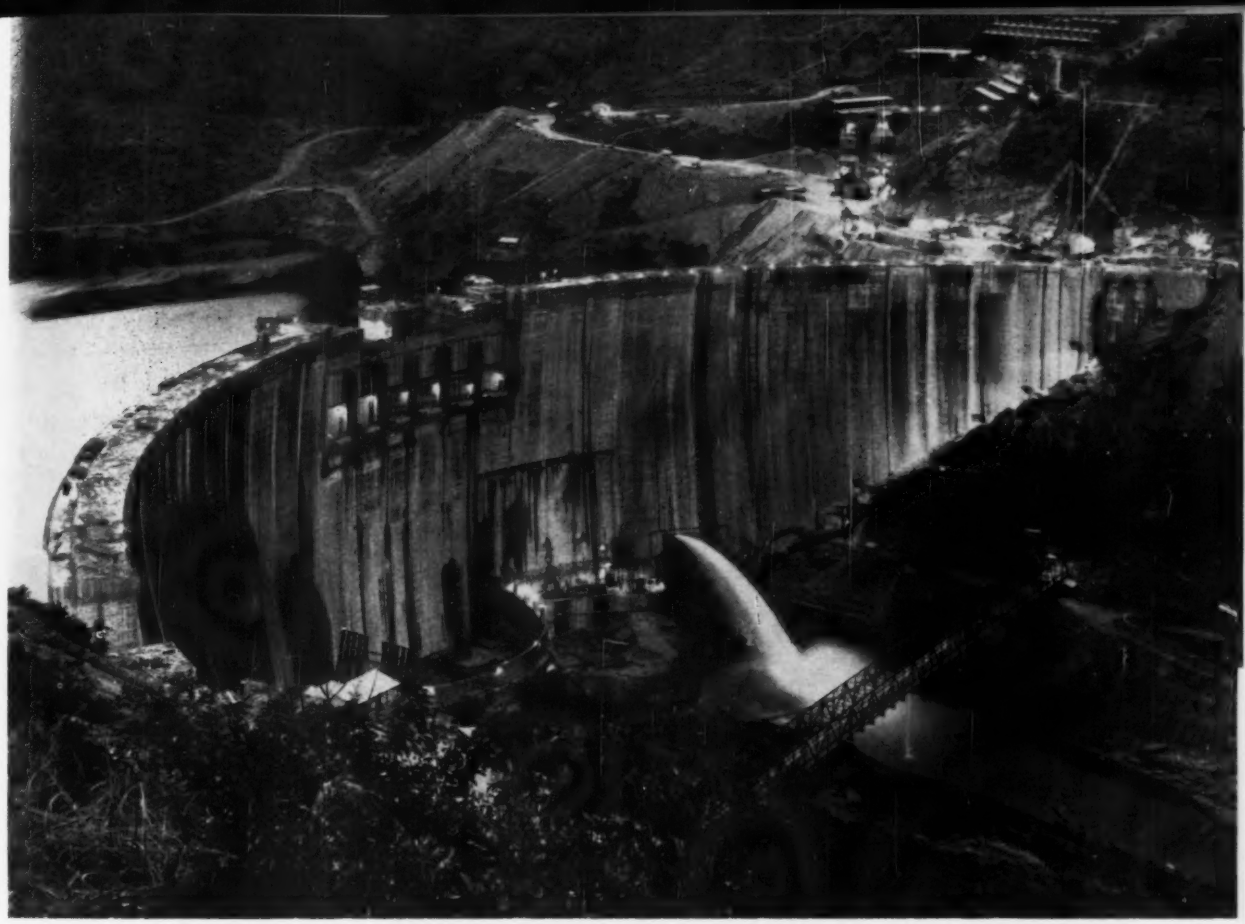
The Russian business has led to orders for nine 525-kv auto transformers and switchgear. Delle (part of the Générale d'Electricité group) displayed one pole of the breaker, which is rated 2,000 amp with 25,000-Mva symmetrical interrupting capacity. There also was a pantograph type disconnect for 525 kv, another development due to the Russian orders. Electricité de France, the nationalized utility, showed a 400-kv, 100-Mva auto-transformer which, extrapolated to 525 kv by Savoisenne, will be part of the order.

American and other visiting engineers attended sessions of Committee 14 of the International Electrotechnical Commission, whose meetings, along with other IEC committees, were held at the exhibition. The delegates were interested in CEM's patented transformer design.

This CEM unit has three cylindrical cores clamped by top and bottom pieces of special design. Each piece is made up of a ribbon of extra-low-loss steel wound in spiral form round a triangular former, resulting in a flat "disc", the thickness of the ribbon, with a triangular hole in the center. The three vertical cylindrical cores, with their windings, are placed on the bottom disc, then the top disc is added. Three core-centered clamping rods keep the whole assembly rigid.

The resulting unit is said to have reduced dimensions and losses, rating for rating, as compared with any other design. The symmetry of the active part assists in standardizing sizes, easing erection, and permitting bushings to be mounted in any position to suit requirements. "ISOCEM" units are made from 16 kva to 4,000 kva, up to 30 kv.

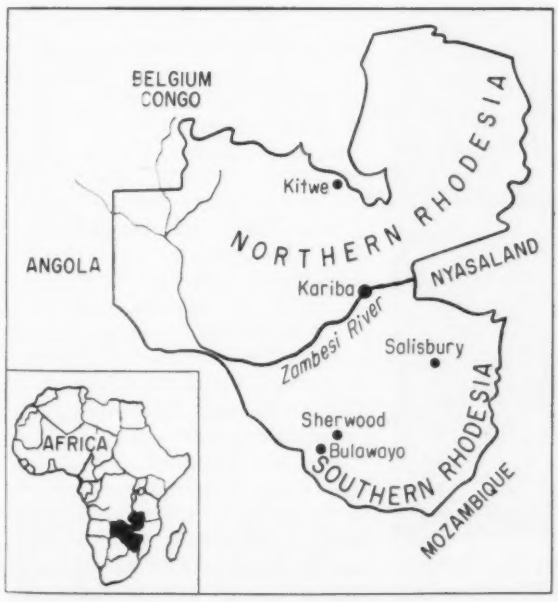
Electricité de France's "bulb-type" hydro turbo-generator continues to interest engineers, particularly those from America and Russia. Made in the form of egg-shaped enclosures, these units contain a turbine of the Kaplan type, with fixed or movable blades directly coupled, or sometimes geared, to a generator. They are submerged almost horizontally in water passing through a suitable hole in a dam with heads of 10 ft or even less.



Kariba: Big Test of Men and Machines

DAVID COLE, Correspondent, Salisbury, Southern Rhodesia, McGraw-Hill World News

Dam wall is completed in 33 months despite heat, floods, and transportation difficulties



The dam wall of the Kariba hydro scheme on the Zambesi River has been completed and the biggest man-made lake in the world is filling. The 20 x 175-mi lake will hold 130-million acre ft of water which will drive five 100-Mw turbo-generators in the first stage of the $300 million project. Ultimate capacity will be 1,200 Mw.

A series of difficulties faced Impresit Kariba, Ltd, main contractors, who nonetheless completed the dam wall 14 months ahead of schedule. First was the out-of-the-way location. On the south bank the project was 58 mi from the nearest road and 144 mi from the nearest railhead. On the north bank it was 62 mi to the nearest road. Access roads were built to the main Salisbury-Lusaka road and an airfield constructed near the site.

Next came the floods; one in 1957 and another in 1958. In the first one, the north bank coffer dam was flooded and work delayed two months. A record flow of 585 cu ft/sec in 1958 flooded the main coffer dam, destroyed a suspension foot-bridge and a road bridge, washed away equipment and buildings near the site.

Intense heat and humidity during the fall made work-

(*Continued on page* 152)

AIEE Summer Meeting Features Dual Lamme Medal

P. L. ALGER AND STERLING BECKWITH, holding their Lamme Medals, following presentation. B. M. Cain(left), L. T. Rosenberg, and Mark Princi (right) officiated

L. F. HICKERNELL congratulates his successor in the AIEE presidency, J. J. Foote. H. R. Loew, General Electric Co, Seattle, presided as general meeting chairman

Beckwith and Alger are first to share honor in 30 years; Foote to succeed Hickernell as 1959-60 AIEE president

The 1959 Summer and Pacific Meeting of the American Institute of Electrical Engineers, June 21-26, at Seattle, Wash., was featured by the first dual award of the Lamme Gold Medal in 30 years. The medal is awarded annually to the engineer "who has shown meritorious achievement in the development of electrical apparatus or machinery," as determined by a nine-member AIEE award committee.

This year's medalists are: Sterling Beckwith, consulting engineer, Lake Forest, Ill, formerly with Allis-Chalmers Mfg Co, and, Philip I. Alger, Schenectady, N. Y., a retired General Electric Co engineer.

The opening session also heard announced that James H. Foote, Jackson, Mich., is the 1959-60 AIEE president. He is chief engineer of Commonwealth Associates and vice president and director of engineering, Commonwealth Services, Inc. The announcement followed a tally of a mail ballot by the Institute's over 52,000 members.

Foote succeeds L. F. Hickernell, Anaconda Wire & Cable Co., who presided at Seattle.

Vice presidents elected were: Donald L. Greene, Gilbert Associates; John W. Davis, Southern Bell Telephone & Telegraph Co; Max H. Kight, U. S. Bureau of Reclamation; George T. Harness, University of Southern California; Dr Rene Dupuis, Quebec Hydro Electric Commission; and, Frederic S. Bacon, Gamewell Co. C. H. Linder, General Electric Co, continues as treasurer.

Directors named are: Hendley N. Blackmon, Westinghouse Electric Corp; Estill I. Green, Bell Telephone Laboratories, Inc., and Sven M. Osthagen, Allis-Chalmers Mfg Co.

Presentation

L. F. **HICKERNELL** gives presidential address at the opening general session of the American Institute of Electrical Engineers' Summer and Pacific General Meeting in the Spanish Ballroom, Olympic Hotel, Seattle, Wash., June 22

Nuclear Plants Exceed 1,000 eMw

High capital cost proves chief difficulty in A-plants initiated under 1954 Act. Savings to come in optimizing future designs

Nuclear power plants initiated under the 1954 Atomic Energy Act today exceed 1,000 eMw, H. E. Vann, Atomic Energy Commission, told the nuclear session.

None of these plants has encountered the operating difficulties that had been anticipated. The chief difficulty, Vann indicated, was high capital cost and new technical problems for which no "magic break through" is likely. Savings must be sought in optimizing designs, he said, adding that economic nuclear power is unlikely before 1965-70.

The seven reactor concepts receiving most attention—pressurized water, boiling water, sodium cooled, homogenous, heavy-water moderated, organic moderated, and gas cooled—offer unknown promise for economic power generation, Vann said, and it is probable that several will prove successful.

Vann cited boiling water as an example of progressive development. After four reactors in the Borax series proved the concept stable and safe and established design data, the EBWR powered a 5-Mw turbine generator in 1956 without prohibitive radioactivity in the turbine. Estimated production cost was 31.8 mills per kwhr.

Then the Vallecitos BWR, operating at 1,000 psia, extended design data to support the 180-eMw Dresden unit scheduled for early 1960 operation, he noted. Successive steps in this series will cut power costs to 11.1 mills per kwhr in the 150-eMw SENN plant in Italy by mid 1962, Vann estimated.

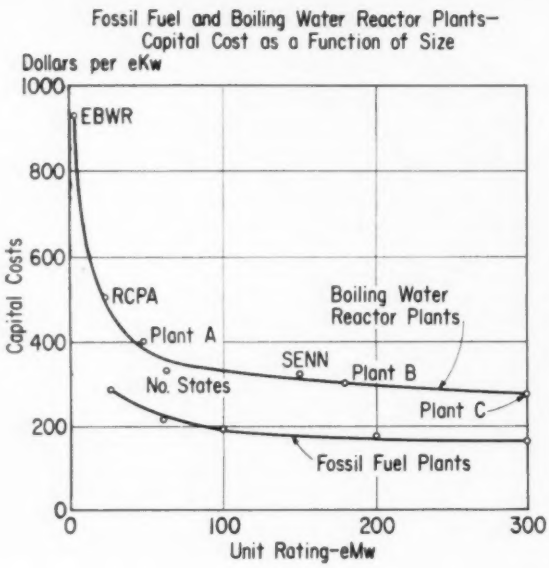
There is reasonable hope that nuclear fuel cost can ultimately be lower than fossil fuel. This, said Vann, would allow a nuclear plant to become competitive with a fossil-fuel plant at somewhat higher capital cost. Some nuclear plants under construction today may ultimately provide power competitive with fossil fuels, said A. R. Jones, Westinghouse, in a paper co-authored by C. F. Currey and R. A. Rydin. Competitive A-power is expected in many areas within 5 to 10 years. Additional incentive can come from demonstration that atomic plants are better than fossil-fuel plants.

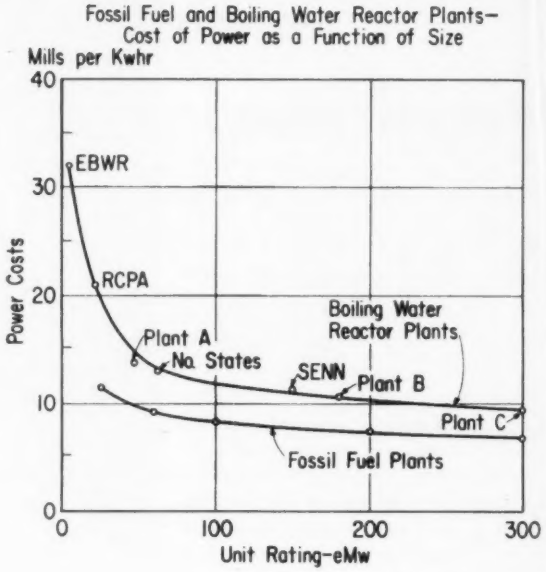
Reactor control systems are determined by plant design philosophies, continued Jones. Containment structures restrict access to coolant controls, necessitating extensive use of remote instrumentation and control. Electrical systems are preferable, he said, because their penetrations of the shell can be sealed securely. But such systems must provide controlled stability, high reliability, and protection to equipment and personnel in event of failure. Controls must be adopted to match reactor characteristics, thermal coupling, and system stability, Jones concluded.

Automation Frees Operators

Automation takes decision-making responsibility away from the operator and gives it to the control equipment designer, said E. G. Norell, Sargent & Lundy. Thus it applies the exact judgment of boiler, turbine, and generator specialists and circumvents the selection and training of skilled operators. He cited existing installations of automatic data logging as a potential source of intelligence to actuate an automatic control system. Such systems can pay off, he said, in freeing operators to control more equipment from centralized consoles.

Brownlee hydro plant in service less than a year has put more than 500 Mw into the Idaho Power Co system, said D. R. Russell, presenting a paper by C. N. Teed, L. O.





Evans, M. E. Byrne, and himself.

Transmission of this output is by three 230-kv lines, two of double-circuit tower construction directly into Boise and the third tapped to the H-frame line which interconnects with Bonneville Power Administration, he said.

Voltage is controlled by a 60/72-Mvar synchonous condenser connected to 2,100-Mva step-down units at Boise and a switched reactor connected to the third, he said.

Other system changes, such as re-insulating a 138-kv line for 230-kv service, relayed the Brownlee power to the more remote load centers.

Lines were surveyed by aerial mapping and designed to fit contours plotted from the mosaic, he said. Line protection is initiated generally by directional comparison, using several combinations of microwave and carrier for blocking and control.

Task Force Plans System Expansion

"Gaming" plus statistical methods enable manufacturer-utility team to analyze long-range growth with computer

Modern mathematics, coupled with high speed computers, offers electric utilities a powerful new approach to the perpetual problem of expanding system capacity economically to meet load requirements. Following introduction of the "gaming" concept of planning by J. K. Dillard, Westinghouse, and H. K. Sels, Public Service E&G, several working groups from the manufacturer-utility task force described steps in application of the new method.

TASK FORCE heads Dillard and Sels confer with F. I. Lawson, PG&E (r to l)

A new method of predicting forced outages of generators relates machine availability to records usually kept by utilities, claimed D. P. Gaver and C. J. Baldwin, both Westinghouse, and C. H. Hoffman, Public Service. The new method, by using "gaming" to represent human decisions and random events, surpasses earlier probability solutions, they claimed. It is versatile enough to predict available capacity vs the peak load on a daily basis.

Records show that availability of generators and forced outages may be approximated with exponential distributions, they reported in a companion paper coauthored by J. E. Billings, Public Service. This analysis of steam plant performance revealed that many forced outages are delayed until weekends to avoid capacity impairment during heavy load periods. It also revealed that many outages cut less than the full rated capability of the unit.

Savings are gained by shutting down any generators not needed for load or spinning reserve during the next two hours, concluded C. J. Baldwin and K. M. Dale, Westinghouse, and R. F. Dittrich, Public Service, in another of the task force papers. The criterion varies with units, they said, and could be boosted to 5 hours for high pressure units. Whether the boiler will

be banked or allowed to cool depends upon cost, but banking is preferred for short shutdowns.

Fuel savings of $100,000 or more per year can be realized by equal incremental scheduling of all thermal machines on two interconnected utility systems, said Americo Lazzari, Arizona PS, referring to his company and the Salt River Power District. Incremental transmission losses are included when assigning penalty factors.

Uses Slide Rule

A unique slide rule has been developed by Arizona PS personnel to schedule generation from each plant on both systems. Eight main slides are provided for station incremental cost curves, each containing a sub-slider to allow for variations in heat content of the natural gas. The slide rule offers a convenient way to demonstrate to system dispatchers the savings available from various schedules. It is also used for actual scheduling, he said, merging the load schedules of both systems to serve each with less installed generation, making fuller utilization of existing facilities, and enabling new generating equipment to be added in more economical unit sizes and timing.

Billing for economy energy in a power pool can best be handled by making the value of interchange independent of the direction of power flow, according to P. G. Lubisich, Los Angeles Dept of W&P. He proposed simple multiplication of tie-line kw by tie-line incremental cost, a method usable by any number of utilities in the same pool.

Regardless of load characteristics, dumping a large overload on a generating station may cause the frequency to drop so rapidly that automatic relays are necessary to prevent swamping of generators and to permit rapid restoration of limited service, said C. F. Dalziel, University of California and E. W. Steinback, Kaiser Engineers. Load shedding may be an important aspect of protection for parts of a power system and for industrials which generate only a portion of their energy requirements.

Reduces Switching

Frequency and reverse power relays may reduce unnecessary switching since a breaker operation is prevented unless the load carried by the breaker is at least partly responsible for under frequency. Selected loads may be dropped by frequency sensitive relays. Loads likely to stall and cause damage to equipment, such as ore crushers and rolling mills, should be prevented from being recharged during the period of serious under-frequency.

Switching Limits Transmission BIL

Improved arrester characteristics bring change in placement for lightning, lead to more emphasis on switching surges

Improvements in arrester characteristics and the trend toward reduced insulation levels reduce the margin between withstand levels and the arrester protective level to a point where switching surges are of equal significance to lightning surges, said I. B. Johnson, General Electric. Switching surges might require arresters between the circuit breaker and transformer.

Speaking for four GE authors, Johnson said a transient network analyzer study of lightning surges suggests that arresters could be located, in some cases, farther from transformers than previously recommended.

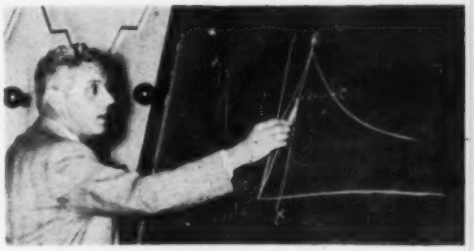
In discussion, S. L. Foster, Allis Chalmers, suggested that the curves allow for steeper wave fronts.

Transient overvoltages in excess of switching surge spark-over of modern station arresters may occur through sequential closing of switch contacts when energizing an uncharged transmission line, said A. J. Schultz and I. B. Johnson, both GE. The value may reach 2.5 per unit of normal line-to neutral crest voltage when an open-ended line is energized, according to a transient analyzer study. When the line is terminated in an unloaded transformer, voltage in excess of 3.0 per unit may occur, but these voltages will be lowered to spark-over voltage of the arrester used to protect the transformer, they said.

In discussion, Ed Garry said Bonneville Power Administration will soon have experimental data with and without autotransformers terminating the line. Preliminary indications show maximum values of 2.8 and 2.3 times, respectively.

Graphs presented by A. H. Knable, Allis Chalmers, provide an aid to designing adequate lightning protection for a multi-line bus and a means of determining voltage magnitude at various points on an existing system. Both self-protected and arrester-protected systems were included.

J. W. Kalb, Ohio Brass, commented that arresters can no longer be based upon lightning surges alone but must include consideration of switching surge spark-over.



STEEP WAVES are acceptable if below chopped test, says I. B. Johnson, GE

European engineers have been more concerned than U. S. engineers with switching surges due to interruption of transformer magnetizing current, reported R. T. Curto, Detroit Edison, and H. K. Amchin, AEP Service Corp. This may reflect the prevalent American practice of installing arresters on transformer terminals, differences in types of circuit breakers, and system configuration, they said. But current emphasis and refinements in station protection in this country may require more detailed consideration.

Assuming that transmission line conductors at 230 kv and higher will have satisfactory load capability if radio and TV interference

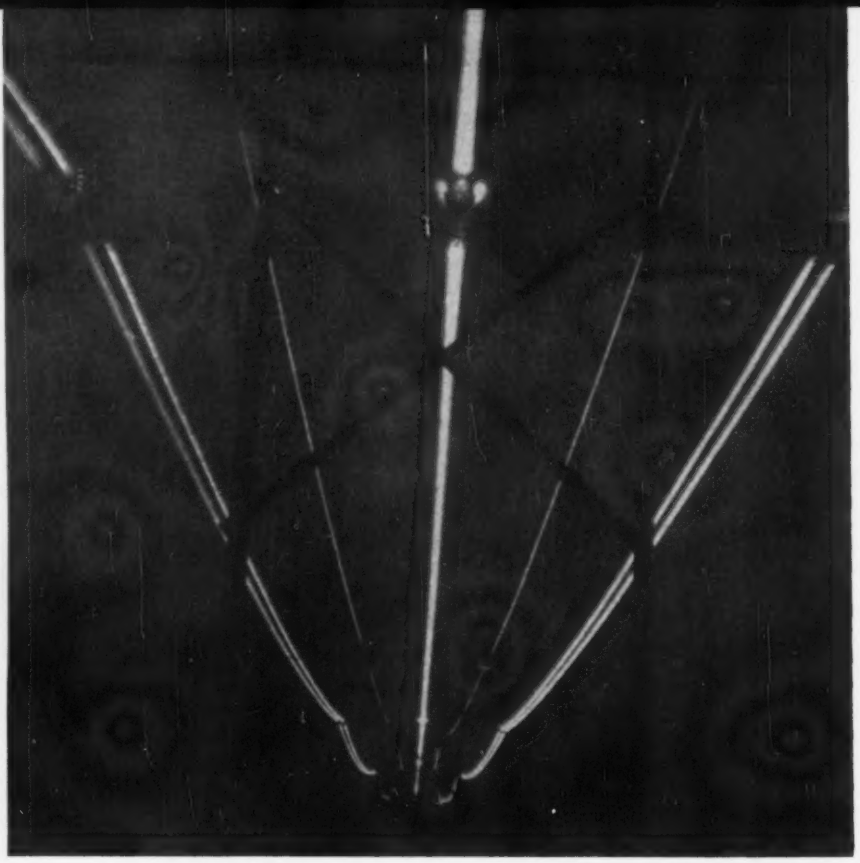
(*Continued on page* 179)

Photos

Fast film supplies detailed data on corona and arcing on Leadville, Colo., conductors, ground wires and hardware

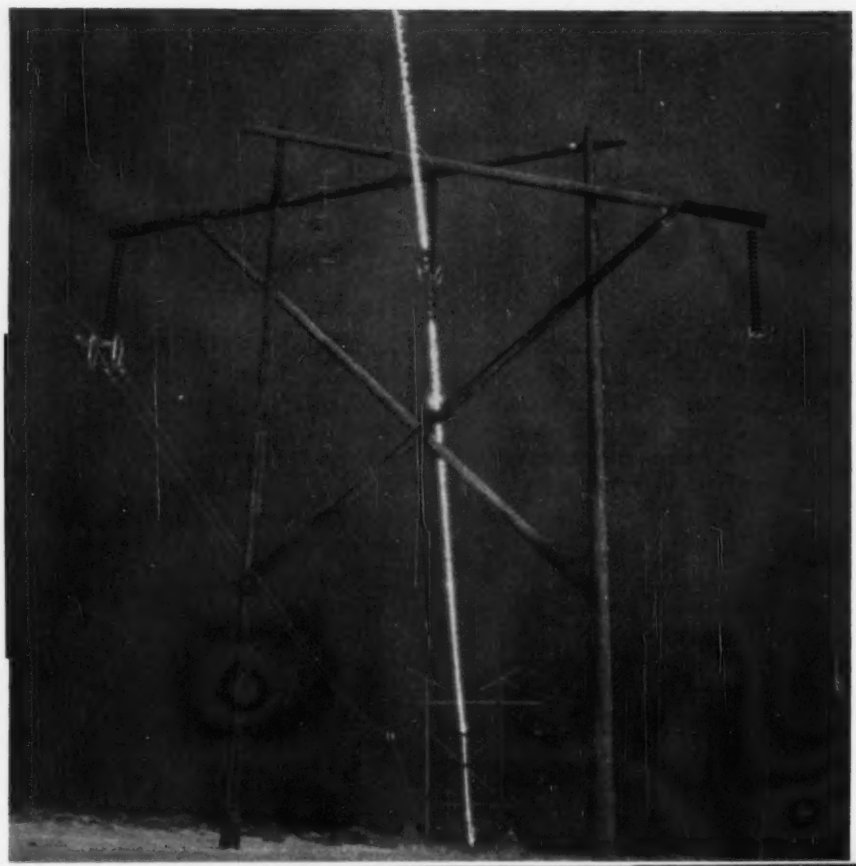
L. M. ROBERTSON, Chief Electrical Engineer, Public Service Co of Colorado, Denver, Colo.

J. E. O'NEIL, Advanced Development Engineer, Electric Utility Engineering Dept, Westinghouse Electric Corp.



ALL CONDUCTORS are energized at 275 kv to ground (330 kv equivalent 3-phase) in night view of Leadville line with camera at F 3.5, 3-min exposure

1.65-IN. CONDUCTOR is energized at 265 kv to ground (403 kv equivalent 3-phase) in fair weather. Note arcing on hardware near right-hand pole top



Photography simplified the finding of corona, arcing, and potential noise sources at the extra-high-voltage test project conducted by Public Service Co of Colorado, Westinghouse Electric Corp and others at Leadville, Colo. Photographing of such phenomena was made possible by the use of ultra-fast film available only in the past few years.

This technique offers the designer one more means of investigating and improving transmission line performance.

Photographs of the experimental line, on which conditions are greatly exaggerated over those on utility operating lines, indicated:

1. That corona occurs on ground wires and hardware, as well as on conductors.

2. That in foul weather corona loss on a conductor may be 50 to 100 times greater than in fair weather.

3. That corona performance varies on conductors operated at the same voltage with respect to ground.

The Leadville EHV Project, constructed of 3-phase tower designs, is energized from a single-phase source. Motor-operated disconnect switches in the substation control the energized phase during testing. Conductor configurations tested were:

1. A two-conductor bundle of 1.4-in. expanded ACSR.

2. A 1.65-in. expanded ACSR conductor.

3. A two-conductor bundle of 0.92-in. ACSR.

When all 3-phase positions are energized from the single-phase transformer, gradients on the over-

Show EHV-Line Noise Sources

head groundwire are much higher than those occurring when only one phase position is energized and the others grounded. When all three conductors were energized at 275 kv to ground, corona on the ground wires was such that it is apparent in the upper left-hand photo. The left, two-conductor 1.4-in. bundle has the least corona at this voltage, showing the least light.

The radius of corona plumes around the 1.65-in. conductor in the center position can be estimated from the insulator grading ring, which indicates a corona diameter of 16 to 18 in. Further work is being done to correlate corona discharge diameter to corona loss.

The lower left photo suggests that corona loss on a conductor may be 50 to 100 times greater in foul than in fair weather. The photo shows the 1.65-in. conductor energized at 265 kv to ground (403 kv, 3-phase equivalent) in fair weather. An arcing spot between two pieces of hardware appears near the top of the right-hand pole.

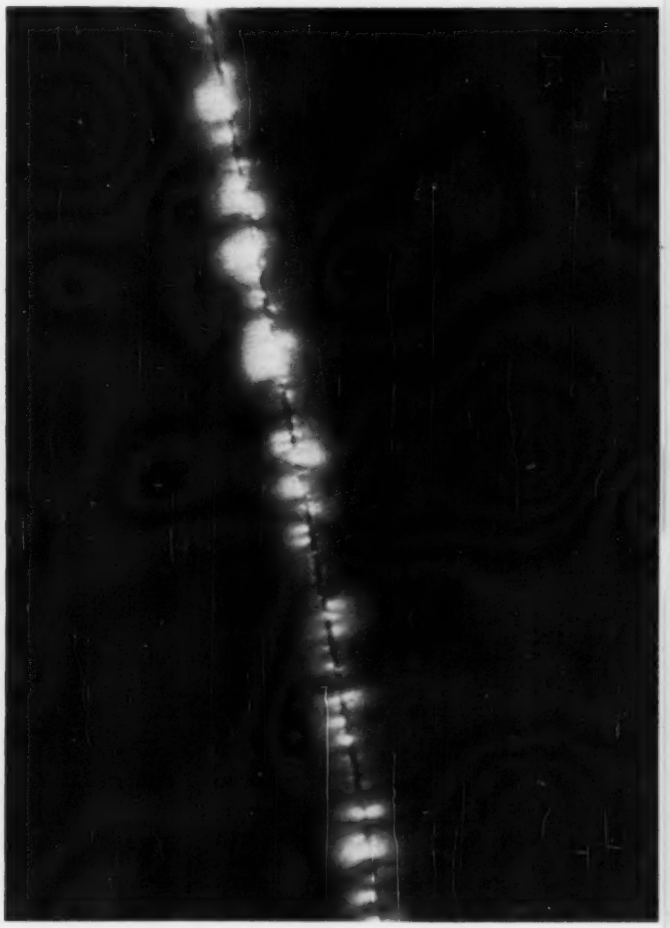
When voltage was reduced to 243 kv to ground (377 kv, 3-phase equivalent), the diameter of the corona plumes increased several times due to the weather conditions produced by a light fall of dry snow, and the arcing on hardware virtually disappeared.

The photographs immediately below are closeups of conductor corona, taken with 275 kv to ground on the three conductors. The two-conductor, 1.4-in. bundle (left) shows more corona on the conductor nearer to the ground wire. Again, corona discharges from the ground wires are visible.

Details of corona were photographed through the use of Kodak Royal-X Pan Film, which has a recommended exposure meter index of 1,600. Ansco Super Hypan has a comparable speed. With both, special care in handling is necessary.

The only ambient light during the taking of these pictures was from Leadville, about a mile away, and from the corona itself.

TWO-CONDUCTOR, 1.4-IN. BUNDLE shows more corona on conductor nearer ground wire despite similar voltage



NIGHT VIEW of 1.65-in. conductor, charged at 275-kv to ground (320 kv equivalent 3-phase) needed 5-min exposure

FIG. 1 – THEORETICAL RANKINE CYCLE

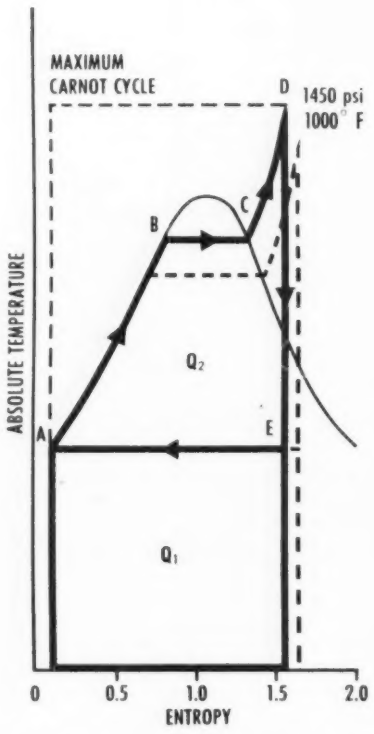


FIG. 2 – REGENERATIVE CYCLE

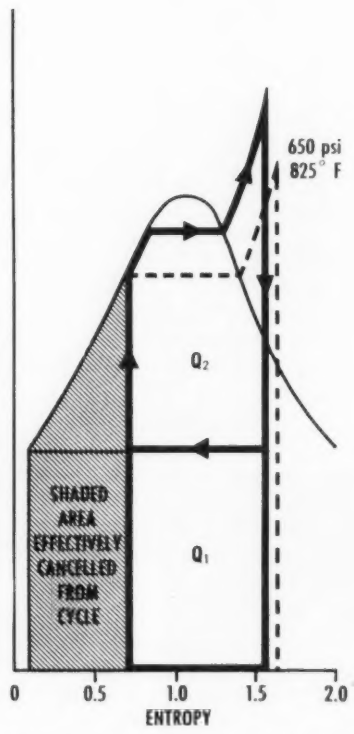


FIG. 3 – REGENERATIVE AND REHEAT CYCLE

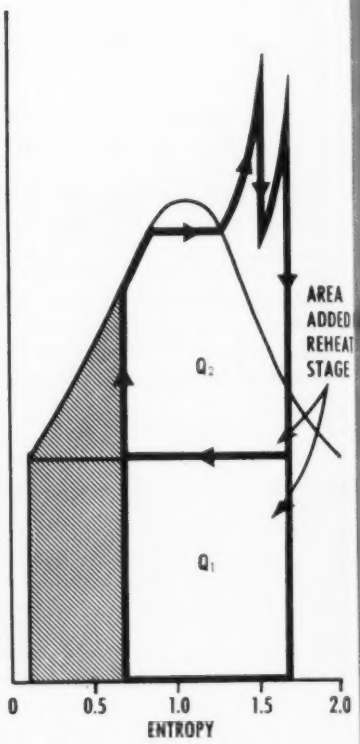


FIG 1-4—THEORETICAL RANKINE CYCLE (Fig 1) is the ideal sought in steam plant. Fig. 2, 3, and 4 show improvements made in the cycle efficiency through the addition of regenerative feedwater heating, reheat, and superpressure

How Supercritical Cycle

Supercritical-pressure cycle enables generating station designer to off-set rising fuel costs with efficiency

S. W. W. MITCHELL, Supervisory Engineer, Apparatus Section, Large Turbine Engineering Department, Westinghouse Electric Corp, Lester, Pa.

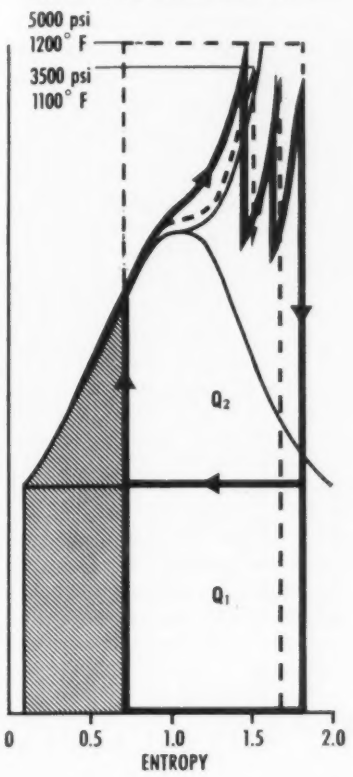
The supercritical-pressure cycle has extended opportunities for further economies in power production cost. Steam plant designs today have new methods for building in higher efficiency to offset rising fuel costs.

Experience with 3,500-psi and 5,000-psi units now nearing completion will test out designs which, in the former, push ferritic steels closer to their 1,100F operating limit and, in the latter, resort to austenitic (stainless steel) alloys for 1,200F inlet steam.

Both designs admit steam at pressures where vapor and water have equal volume, a condition which for many years seemed as much a barrier to turbine designers as the sonic barrier was to aircraft designers. Now that the steam barrier has been breached, it is interesting to observe how the supercritical cycle aids efficiency.

The evolution of the steam cycle and its efficiency can be shown graphically on the temperature-entropy chart. The theoretical Rankine cycle is shown in Fig 1. Tracing the cycle, from A to B, fluid is compressed by application of pressure and heat; B to C, constant-temperature phase change from water to steam; C to D, superheat of saturated steam; D to E, expansion of steam through turbine; E to A,

FIG. 4 – SUPER-PRESSURE CYCLE



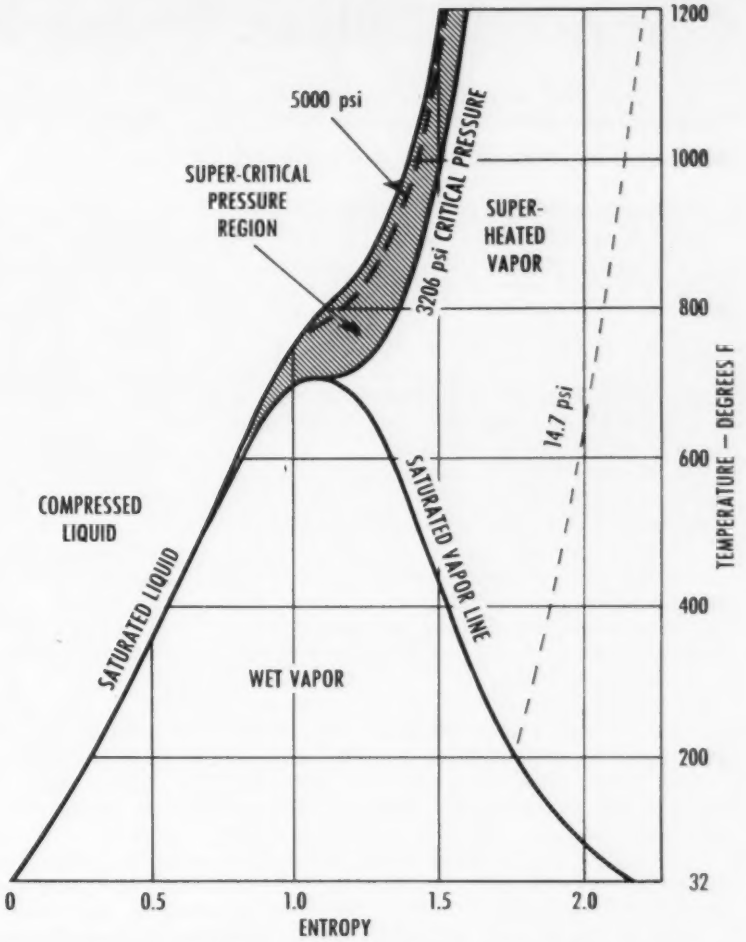


FIG 5—TEMPERATURE-ENTROPY CHART of steam turbine cycle shows traced area proportional to work done. Supercritical cycles use region above critical line

le Boosts Steam Plant Efficiency

steam condenses to water through condenser.

If perfect processes are assumed with no losses, the area Q_2 within the cycle represents the work done by the cycle. The area below the cycle, Q_1, represents available energy in the working fluid which is lost in the exhaust.

Efficiency of the cycle is represented by the ratio of energy developed (Q_2) to total energy available ($Q_1 + Q_2$). Cycle efficiency could be increased by raising temperature and pressure as shown.

The regenerative cycle is shown graphically in Fig 2. Here the inefficient water-heating portion of the cycle is, in effect, cancelled out by extracting steam from the turbine. Although the total work available from the cycle is reduced, the amount of wasted heat is reduced so that overall efficiency is improved.

Further improvement in cycle efficiency is effected by adding reheat (Fig 3) where steam is partially expanded through the turbine, then reheated for another expansion. Graphically, it can be seen that the useful work added to the cycle is greater than the additional rejected heat, so that cycle efficiency is improved. Unfortunately, although several stages of reheating would improve cycle efficiency, the relative gain for each reheat stage soon reaches a point of diminishing returns. Two stages of reheat are generally the maximum number that can be justified today, even on the largest turbines.

The gain in efficiency made possible by the superpressure cycle is shown in Fig 4. Two reheats are shown. Because of the peculiar characteristics of steam as a working fluid, this cycle is the closest approach possible to the idealized Carnot cycle, which would be a rectangle.

Computer Solves Relay Problems

Program calculates line current and swing impedance of selected lines; overall costs are reduced by 4 to 1

S. J. **ZUCKERNICK**, Project Engineer, General Public Utilities System, Reading, Pa.
G. W. **STAGG**, Computer Applications Engineer, American Electric Power Service Corp, New York, N. Y.

The automatic operation of impedance-type relays during power system disturbances has been simulated on a digital computer. The program complements American Electric Power's IBM 704 transient stability program (EW, Sept. 1, 1958, p 49). This new approach to combined transient-relay studies reduced the solution time of studies formerly requiring two weeks to less than three hours and reduced engineering effort 25 to 1. Overall costs were reduced 4 to 1.

Other advantages are: Complete automatic tabulation of system voltages, line currents and swing impedances; the ability to study a greater variety of relay and switching schemes; greater utilization of the digital computer by eliminating manual intervention in the calculation; and greater accuracy.

Moreover, the program helps relay engineers to set blocking relays properly. It is now economical to analyze a transient system completely and select to best use of a blocking relay. This will also allow realistic use of tripping relays for "out of step" condition to select breaking points on a system, creating areas in which generation more nearly meets load.

The combined stability and relay program was used to analyze transient effects and resulting relay operations on the GPU system. Three different fault locations and two machine tripping sequences were tested. The system studied consisted of 104 system buses, 169 transmission lines, and 23 synchronous generators.

The study involved 11 cases (Table) and required 2 hr 53 min on the computer, at a cost of $1,006. Engineering and travel expenses were about $100. A similar study using a network analyzer would have required over two weeks and the full services of five people to perform the necessary hand calculations. Similar studies in the past have cost GPU about $4,100.

The data required by the relay program includes: tripping characteristics of relays, i.e., diameters, angles, and reverse reach of the circle diagrams up to four zones per terminal; timer relay settings for the various zones; and inherent relay and breaker times. Either carrier or non-carrier schemes may be represented and out-of-step blocking can be simulated for zones 1 and 2 for both time delay and instantaneous tripping.

The relay program calculates the line current and swing impedance of selected lines at each point on the step-by-step solution of transient phenomena. As each impedance point is determined, it is tested against its relay tripping characteristics. When a relay effects a switching operation, the program automatically schedules this operation at the proper time during the swing curve calculation. The scheduled time includes inherent relay and breaker time. For each line that trips, the program punches a card containing the line terminals.

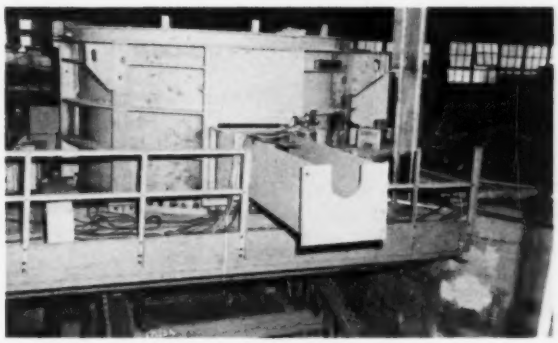
The development of the relay program was a cooperative effort of AEP and GPU. The costs of programming and computer checkout were shared equally.

CASE NO.	ANALYSIS SPAN FROM (SEC.)	TO	NUMBER OF CALC. PTS.	CALCULATING TIME (MIN.)	COST** $	REMARKS
1	0	.92	46	18.08*	105	UNSTABLE - 3 LINES TRIPPED
2	.1	1.0	45	10.33	60	STABLE
3	0	1.0	50	19.75*	115	UNSTABLE- 1 LINE TRIPPED
4	0	.88	44	17.50*	102	UNSTABLE - 4 LINES TRIPPED
5	0	.88	44	18.17*	106	UNSTABLE - 2 LINES TRIPPED
6	.1	.8	35	8.13	47	STABLE
7	0	1.0	50	16.42*	96	UNSTABLE
8	.28	.96	34	10.10	59	UNSTABLE - 3 LINES TRIPPED
9	0	1.0	50	21.25*	124	UNSTABLE
10	0	1.0	50	18.92*	110	STABLE
11	.1	1.0	45	14.08	82	UNSTABLE
			TOTAL	172.73	1006	

* INCLUDING TIME FOR BASE POWER FLOW (3 TO 5 MIN.)
** BASED ON COMPUTER RATE OF $350/HR FOR IBM 704

MANY CASES can be studied in a short time on the computer. Complete automatic tabulation of system voltages, line currents and swing impedances are provided, helping relay engineers to analyze an entire system in a short time

Foundry replaces cupola with...



electric arc furnace as...

Shift To Electric Melting Aims At Economy

ALFRED E. BLAKE, Manager, Engineering, Foundry Dept., Turbine Div, General Electric Co, Schenectady, N.Y.

Improved product quality, greater production flexibility, and a more economical operation are in the offing at two General Electric foundries as a result of a switch to electric arc smelting. The new furnaces, one at Everett, Mass. and one at Schenectady, N.Y., will assure precise control of temperatures and slag chemistry required for the more stringent requirements of the high quality steels used in steam turbines, shells, valves, and other high temperature components. The highly flexible units can produce a variety of products, ranging from grey iron to carbon and alloy steel castings.

One of the main economic advantages of the new units is in their ability to use lower cost scrap such as low density chips, alloy-containing turnings, scrap molybdenum wire, light punchings, and scrap carbon products in lieu of expensive pig iron. Highly valuable alloys in such scrap can thus be recovered with a high degree of efficiency.

GE engineers have found that electric melting is more economical than cold charge open hearth melting in their operations. In contrast to the increases in the cost of labor, fuel oil, and refactories since World War II, the cost of electric power has remained virtually constant.

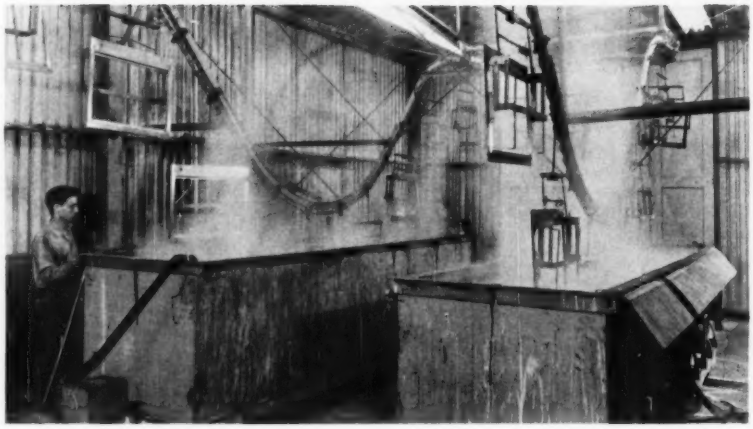
The labor cost with top charged electric furnaces is significantly lower than open hearth melting, particularly when heats from the open hearth are not required on a 7-day, 24-hr basis. Electrical energy is consumed only when a heat is required, whereas, fuel must be burned continuously in an open hearth to maintain the minimum critical refractory temperatures. Moreover, refractory maintenance is less costly because of the better support afforded by the steel shell and the hemispherical bottom of an electric furnace.

In the changeover, two 20-ton acid-lined and one 25-ton basic lined open hearth at the Everett plant are being replaced by one 30-ton basic arc furnace, equipped with an induction stirrer. The new furnace will supplement an existing 12.5-ton and a 2-ton basic electric furnace. All three furnaces will be controlled by GE amplidyne control systems. The new units will also permit GE to shut down three cupola melting furnaces at Lynn, Mass.

At Schenectady, a new 100-ton arc furnace is being installed to produce very large steel castings and high strength gray iron castings, currently produced by two acid lines cupolas. It supplements a 25-ton and 12.5-ton basic electric furnaces already in use. All three units are equipped with induction stirrers.

GE also operates a specialty casting foundry for small sand and shell cast high alloy steel castings. Equipment here includes a one-ton basic electric arc furnace, and two pairs of induction furnaces, rated 300 lb and 500 lb respectively.

TWO INDUCTION FURNACES are used in special casting foundry for small sand and shell cast high alloy steel castings



Feeding electric cleaner...

and paint dryer...

Conveyor Speeds Production, Saves Manpower

W. M. PEEL, Industrial Power Representative, Baltimore Gas & Electric Co.

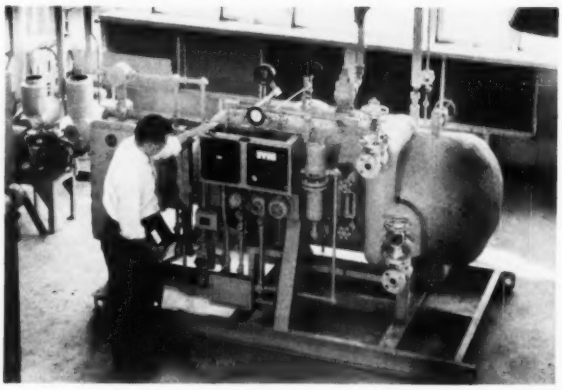
An electric conveyor, teamed up with electric paint drying and degreasing, is paying off in more efficient materials handling and a considerable savings in manpower at Superior Fireplace Co, Baltimore. Part of a new production line that turns out barbeques for home use, the overhead conveyor serves the paint department, the final assembly and inspection area, and the packaging department. At work stations, the conveyor carries the barbeques within convenient reach of the operators. Overhead travel saves floor space and permits free flow of traffic.

The conveyor also performs automatically some of the operations that otherwise would require additional manpower. No attendants are needed for the baking and degreasing because the conveyor moves the work through the processing apparatus and brings it out at precisely the right time. Travel speed is adjustable from 1.5 to 6 ft per minute to accommodate different types of work. Since the painters and other production workers do not have to lift or move the barbeques, they can work more productively.

Degreasing is done in two portable, 800-gal tanks, each equipped with 15 kw heaters. Mounted on wheels and equipped with flexible connectors, the tanks can be rolled away when not in use.

The infra-red oven uses a total of 56 kw of lamps, arranged in two facing banks, which can be moved together or apart to accommodate different sizes or shapes of work.

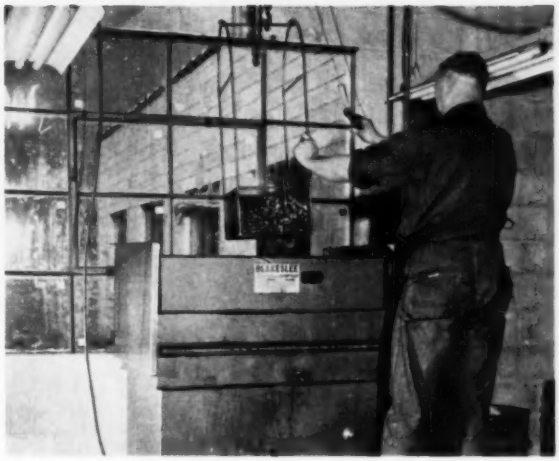
Semi-Portable Heater Is Flexible, Economic



Flexability, low maintenance, and ease of operation are only part of the advantages of a new electric heating unit recently installed in the process research lab of Union Carbide Plastics Co, Bound Brook, N.J. Furnishing precisely controlled heat to jacketed autoclaves and process lines, the dual purpose Hynes heater is used to produce batches of new chemicals for evaluation and to study continuous pilot plant production on a lab scale. Low watt density reduces carbonization in the boiler and cuts maintenance. Accurate temperature of the 40-kw heaters, assures economical use of electricity. The entire system is mounted on a 5 by 9-ft frame which can be moved from one lab set-up to another. Using a Dowtherm heat transfer medium, the unit provides simultaneous vapor and liquid heating.

Electric Degreasing Improves Product Quality

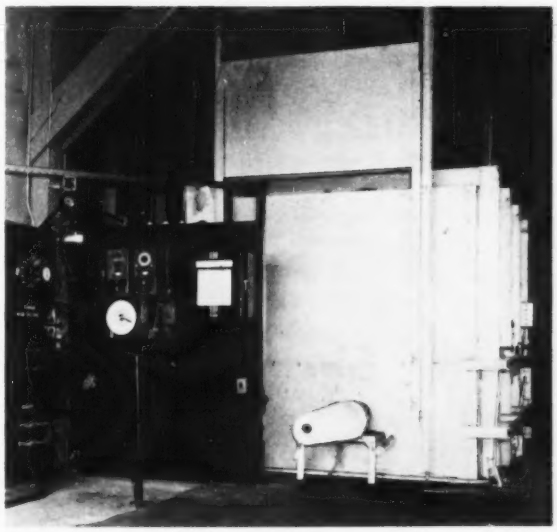
W. F. HUTCHINS, Power Sales Engineer, West Penn Power Co, Ridgway, Pa.



An electric degreasing tank recently installed at the Powdered Metal Products Co in St Marys, Pa. is paying off both in better control of the production rate and in a better quality finished product, according to company president, James Schloder. Using three 3-kw heaters, the degreasing tank gets parts completely clean, and does the job faster, too. Moreover, the company can use any type of lubricant it wishes during the grinding of the parts and still get a clean product.

Before the new electric degreasing tank was installed, bearings, bushings, and gears produced by the company were degreased by an unheated, hand dipping method. The process was slow, costly, and inefficient. It also restricted the type of lubricant that could be used during grinding.

Electric Oven Assures Precision Heat Treating



RALPH O. SMITH, Industrial Power Engineer, Connecticut Light & Power Co, Meriden, Conn.

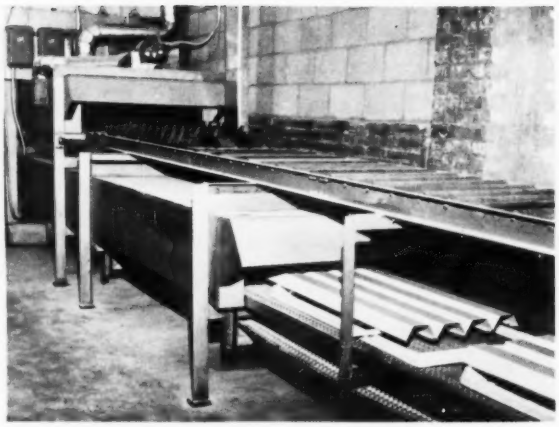
Solution heat treating aluminum forgings to meet rigid government specifications is no problem for Consolidated Industries, Inc, in Cheshire, Conn. A 120-kw electric oven, with automatic controls, provides the uniform temperature and efficient heating that has been found necessary to hold the finished parts to the required size and hardness.

With a normal working range of 875-975 deg F, the oven can process three tons of castings in eight hours after they have been brought up to heat. Molded heaters are installed in the bottom and side walls of the oven. A fan circulates the hot air throughout the unit to maintain a uniform temperature.

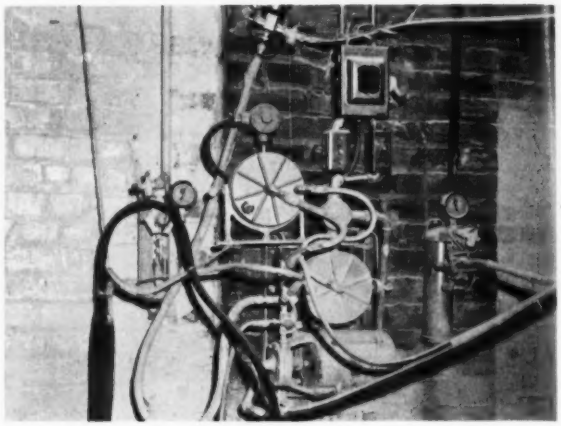
Current plans call for the installation of a second electric oven, which will provide temperatures up to 1,200 deg F, to provide even greater flexibility and widen the range of materials that can be handled.

What's Your Production Problem?

If you have problems in lighting, drying, casting, forging, painting, or materials handling, consult your local power company. Let their experienced specialists show you how to cut costs with electric power.



With infra-red oven and...



paint line heaters...

Electric Heat Improves Finish, Saves Material

BRUCE E. BURGESS, Industrial Heating Engineer, Wisconsin Electric Power Co., Milwaukee, Wis.

A superior product finish, low fabricating cost, savings in material and time – these are the results of a new infra-red oven and a paint preheater recently installed at the Northern Light Co, Milwaukee, Wis. More important, the installations permit Northern to turn out a consistently high quality product, regardless of day-to-day variations in plant temperature and humidity.

After the assembled lighting fixtures have been cleaned and phosphatized, they are conveyed through the top deck of the doubled decker oven for drying. Here the radiant heaters bring the metal to 400 F, completely drying the fixtures in two minutes. They are then carried to the spray area, where the operators transfer them to the painting fixtures.

To reduce the painting time, a small, compact electric heater was placed in each paint line. Located on the side of the paint booth, the heater raised the melamine base enamel to 160 F. The paint then flows smoother, with less solvent. Consequently, the operator can lay down a heavier coat, with fewer passes. The result is a savings in painting time and a reduction in the solvent used.

After painting, the fixtures are placed on the bottom level of the oven, where they are thoroughly baked. Flexible percentage controllers, in conjunction with the two separate heating sections, enable the operating crew to select a variety of baking cycles. At 325 F, a high quality finish is baked in four minutes.

The double decker oven arrangement is a space saver. The safe, cool infra-red oven presented no problems in location. The oven capacity is sufficient to allow installation of a second paint booth.

Electric Shovel Ends Noise And Fumes

ED PAUL, Industrial Sales Representative, Pennsylvania Power & Light Co, Scranton, Pa.

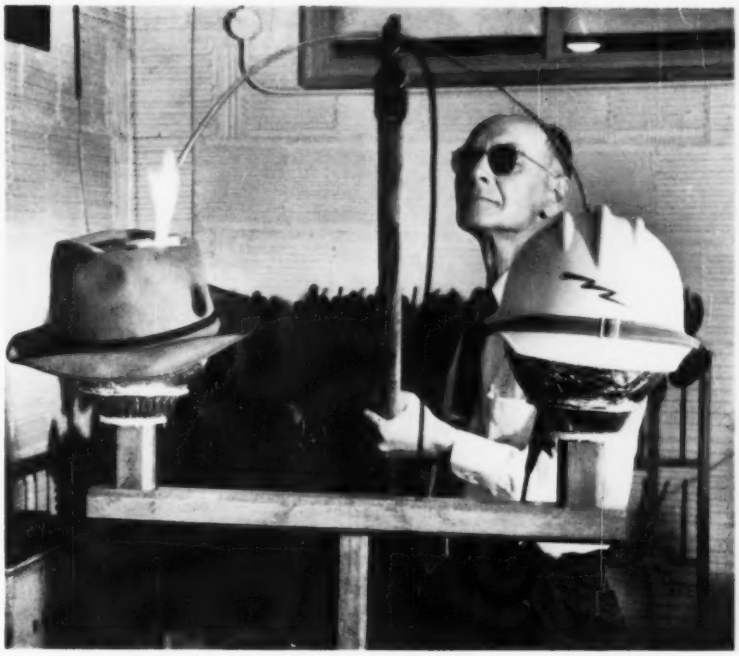
A quiet, efficient electric power shovel helped Harris-Walsh Inc solve a difficult public relations problem in their strip mining operation in Carbondale, Pa, where coal is stripped near a residential area. The problem was solved by replacing a diesel shovel with a 650-hp, 13.5-cu yd electric shovel. The new electric unit not only alleviated the noise and fume problem, but also operates more efficiently and requires less maintenance.

Show How Hard Hat Insulates

Greater safety of an insulated hard hat is shown through use of a demonstrator developed by R. H. McAdams, safety director, Kansas Gas & Electric Co. The unit was used effectively during a tour of all safety meetings over a two-month period prior to institution of a company policy on hard hats.

The demonstrator applies a voltage from a neon-lamp transformer to a hard hat and a felt hat simultaneously. Contact is made by the demonstrator using a hot stick. An arc from the felt hat demonstrates a man's vulnerability; there is no arc from the hard hat.

The new company policy on hard hats is mandatory. It states that all employees who are exposed to injury from falling objects or accidental electrical contact will wear protective hats.



Power Reeler Cuts Cable-Pulling Cost

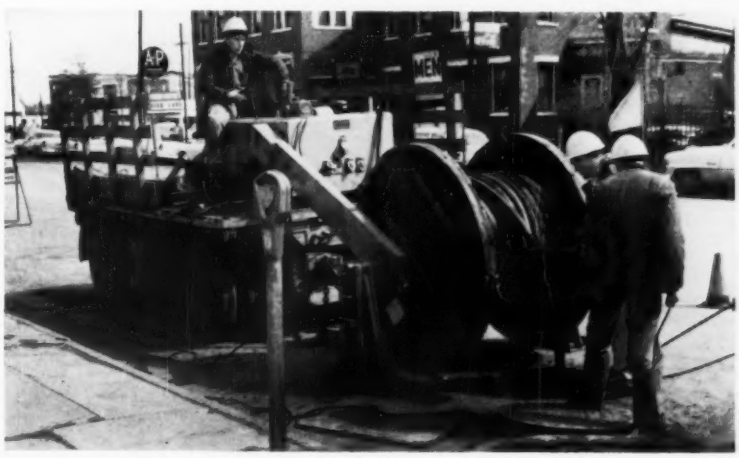
N. BUKEY, Underground Div Foreman, Cincinnati Gas & Electric Co, Cincinnati, Ohio.

A power cable reeler helps Cincinnati Gas & Electric Co cut labor costs in removal of large underground cables for salvage and re-use. A Jensen Power Cable Reeler provides the power necessary to turn the heavy reels, releasing personnel for other work.

Powered by a 6-hp gasoline engine, the unit is mounted on a four-wheel trailer towed by the regular cable-pulling truck. Cable reels of limited size can be carried on the trailer, so that in many cases additional transportation is unnecessary.

The unit was used to reel-in 1,000 ft of 250-MCM 3/c self-supporting aerial cable in recent work. The cable was in reusable condition after being re-reeled. Only one operator and one workman to guide the cable were needed for this job.

(*More EUM on page* 102)



Before you buy another

...transformer... EVALUATE INNOVATIONS

6% of General Electric's distribution-transformer sales goes to improve the product and reduce costs to you

Research in distribution transformers is a catalyst which speeds the normal rate of developments. To make innovations fast enough to keep pace with the unprecedented growth forecast for utilities, General Electric invests over three times as much, per sales dollar, as the average for all industry.

G.E.'s development of production line impulse testing, for example, resulted in drastic reduction in transformer field failure rate. And development of grain-oriented core steel has saved utilities over $300 million. New additions are Permalex* insulation, providing up to 20% more overload capacity, and Melalast* cover finish which cuts service outages.

Other G-E innovations include: Strenicor clamps and bushings for copper or aluminum conductors. The return to you: a more durable and economical transformer to meet your system needs.

Before you buy another distribution transformer, evaluate innovations—give your transformer manufacturer credit for the extra values he gives you. G.E. Co., Schenectady, N. Y.

* Trademark of G.E. Company.

431-80

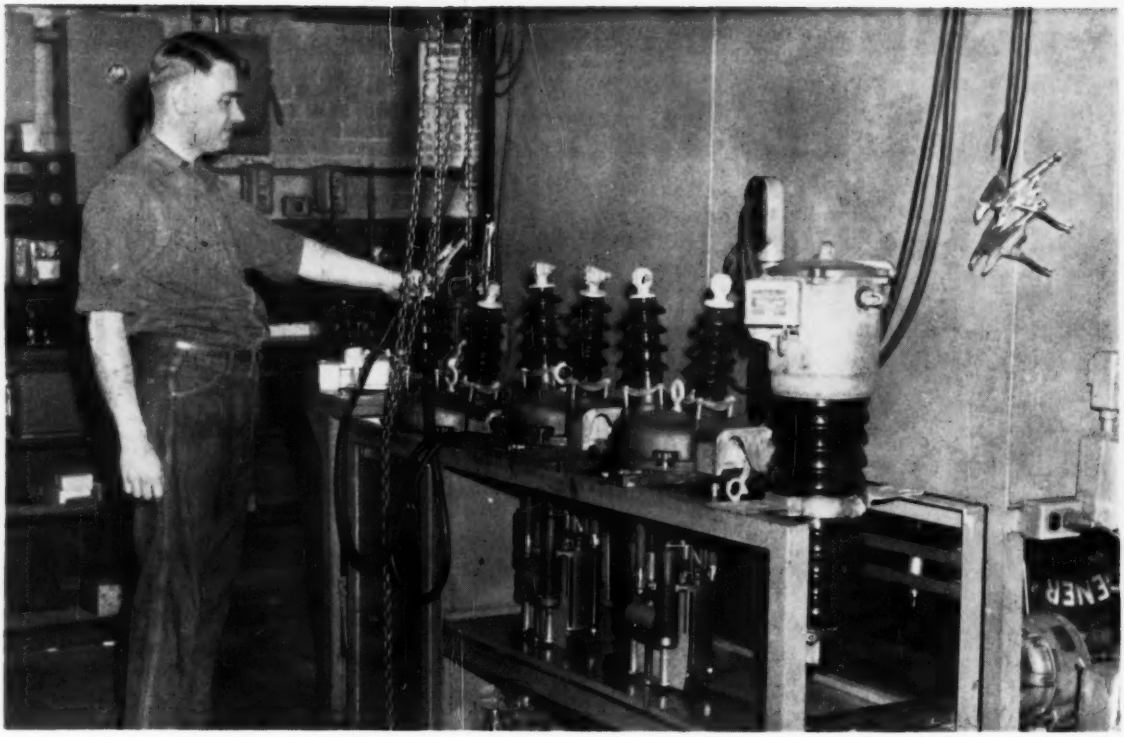
Progress Is Our Most Important Product

GENERAL ELECTRIC

GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU

		G.E.	OTHER MFRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.



Speed 4-kv Recloser Repair and Testing

VERNON NELSON, Supervisor, Electrical Maintenance & Shops Division, Duquesne Light Co, Pittsburgh, Pa.

Line recloser maintenance is handled with greater efficiency on a special repair and testing stand designed for 4-kv pole-top units. Use of the stand has provided Duquesne Light Co with these benefits: Reclosers may be received, inspected, repaired and tested in sequence and flow direction; it will handle the several types of reclosers used.

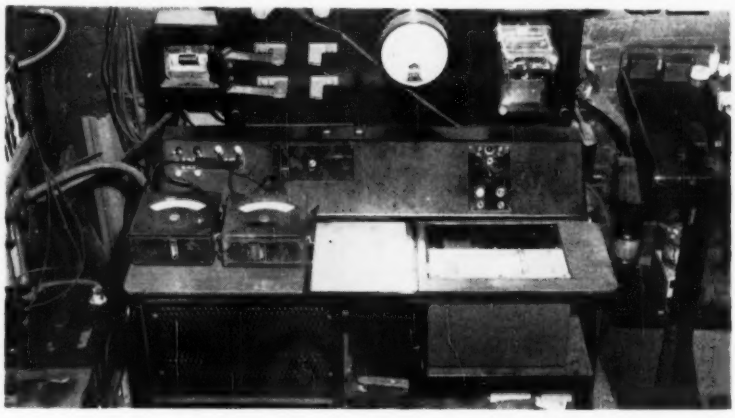
Following the schedule set up by Duquesne Light's distribution department, district line crews remove 4-kv pole-top line reclosers and return them to district headquarters. They are then picked up by the stores department and delivered to the general shop for reconditioning and repair.

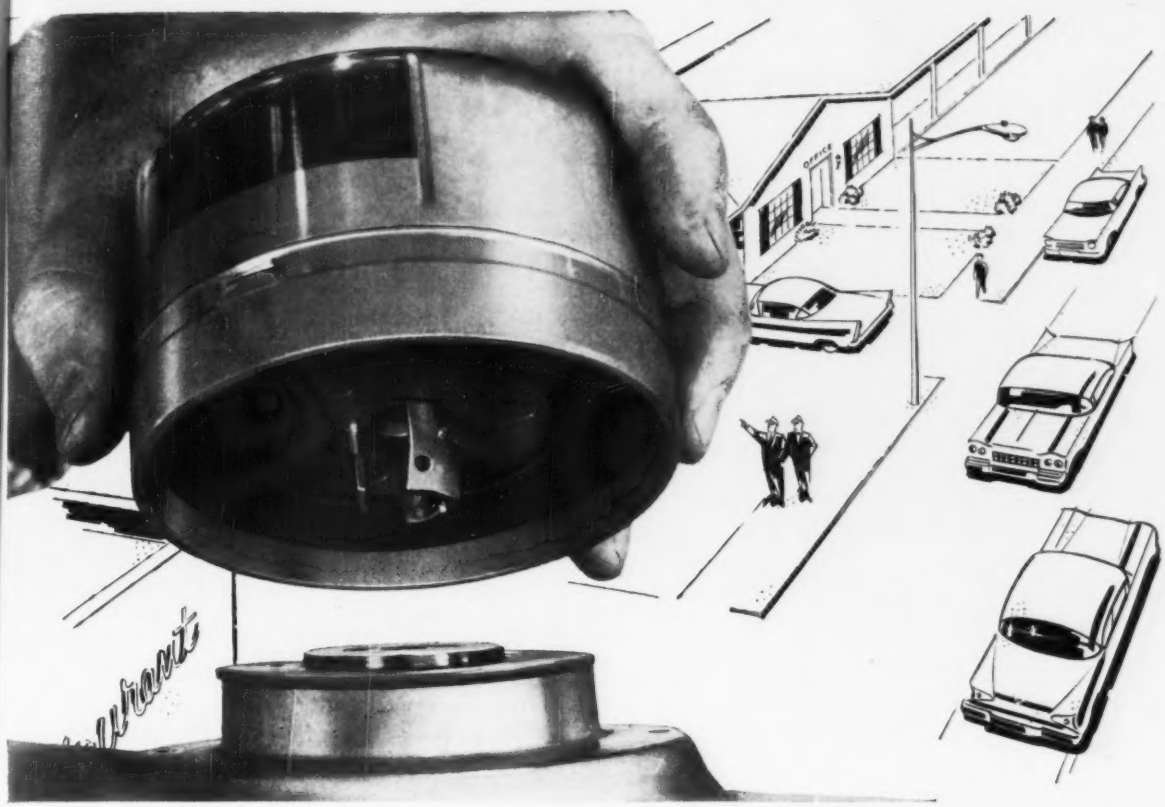
The recloser repair and testing stand in the shop is arranged in a U-shape with a two-compartment tank for clean and dirty oil occupying the center. On one side of the tank is a working-height track for conveyorized open-center trays on which the recloser mechanism is placed for repair. After inspection and repair, the mechanisms continue around to the other side of the oil tank. There they are individually suspended from a beam trolley and lowered into an oil-filled tank with a glass-front panel for observing operation.

Testing leads are located midway on the trolley side of the oil tank and directly above a tanking table equipped with side frames to accommodate both steel-tank and porcelain-body units. Two test circuits are available, one on a 60-cycle, 230-v resistance load to 1,000 amp; the other a dc 48-v, 1,000 amp load.

Proper trip and open-sequence time of the recloser is adjusted by referring to a trace on a sensitized chart on a Sanborn recorder.

SENSITIZED PAPER CHART on recorder provides a trace of a fractional part of a cycle for adjustment of trip and open-sequence time of 4-kv reclosers





Reliable—after years of tests

New G-E cadmium-sulphide control installs in seconds . . . lasts for years

Now, from General Electric comes the industry's newest, most dependable cadmium-sulphide photoelectric control. Years have been spent in the research, design, and testing of this new street lighting control to produce the most efficient, most reliable cadmium-sulphide control available. Now, after exhaustive testing, the reliability problem has been solved with a custom-built General Electric cadmium-sulphide cell. Shock, surge, humidity, vibration, load, temperature—these were among the tests conducted —but none was found to alter the dependable performance of the new G-E control.

Addition of the new cadmium-sulphide cell is but part of the story. General Electric has developed a new, simplified circuit with specially-engineered long-life components . . . designed and built to work together and to reduce your control costs.

Get the full details from your General Electric Apparatus Sales Engineer or Agent, or write Section 450-25, General Electric Company, Schenectady, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ADVANCED DESIGN FEATURES give: (1) dependability from new G-E hermetically sealed cadmium-sulphide cell; (2) long life from specially-engineered components; (3) built-in protection from voltage surges; (4) power savings through accurate external adjustment. NO VACUUM TUBES OR RECTIFIERS.

Now... 2 new medium transformer product

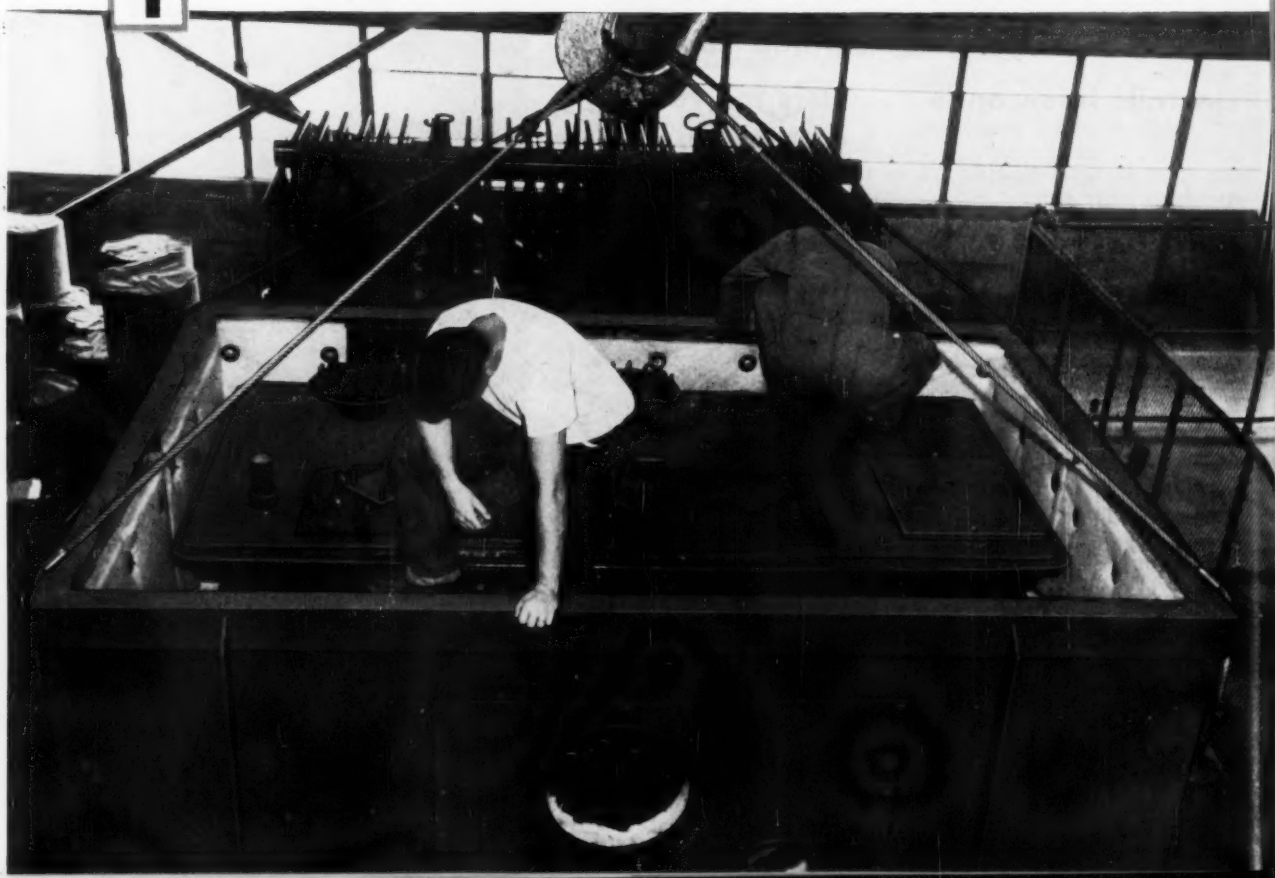
Sound level reductions of almost 20 db and a new low-cost, eas installed substation are making transformer news at General Electr Lowest sound levels yet for medium* transformers are now availab with G.E.'s new pre-fabricated enclosure (also known as "doub wall tank"). And, the reliable General Electric super-compact su station mounts all of the necessary reclosers, lightning protecti fuses, and metering equipment on the medium transformer. Here what these new products mean to you . . .

PRE-FABRICATED ENCLOSURE. Solving the ever-present proble of transformer hum in residential substations has long been the a of General Electric transformer engineers. Construction of sou barriers or the use of low-sound transformers often have proved u satisfactory or too costly. A significant development has resulted fr General Electric research in the form of the pre-fabricated enclosu By placing a pre-fabricated outer tank over a transformer with sep rately banked radiators, sound level reductions up to 20 db have be achieved.

SUPER-COMPACT SUBSTATION. Reliable, low-cost, easily installe this G-E unit is the most economical substation for use in thinly pop lated suburban areas. The G-E super-compact substation has a lo voltage circuit arrangement which is more consistent with normal su

* 501 to 7500 kva, 69 kv and below.

1 PRE-FABRICATED ENCLOSURE



rom General Electric

tion arrangement and application and requires a minimum of acent structure. A super-compact substation can be built around G-E medium transformer.

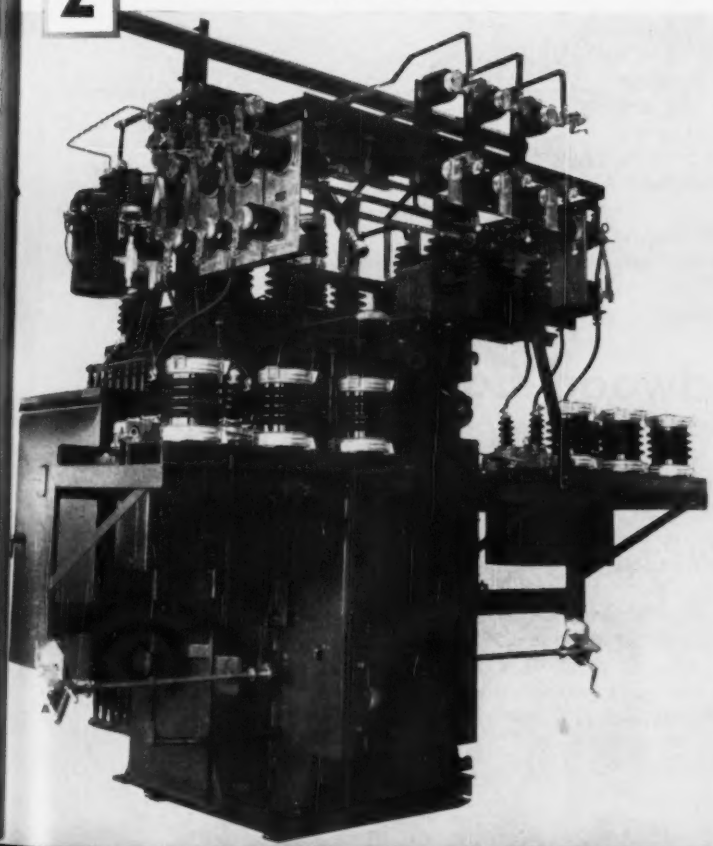
Product leadership is just part of our story. General Electric dium transformers are certified to deliver **full value** for your nsformer dollar . . . in terms of superior products . . . plus faster der handling and shipment . . . plus complete service before, dur-, and after installation. When deciding on your next medium trans-rmer, examine the **complete "package"** offered by General Electric. hen you do, we're confident you'll recognize G-E superiority and w you get full value for your transformer dollar.

For information or application help on General Electric Certified ll-value medium transformers, see your G-E Apparatus Sales En-neer. General Electric Co., Schenectady 5, N. Y. 416-24

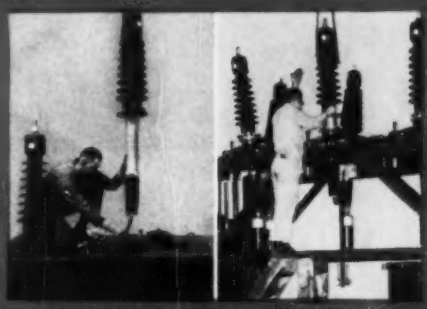
Progress Is Our Most Important Product

GENERAL ELECTRIC

2 SUPER-COMPACT SUBSTATION



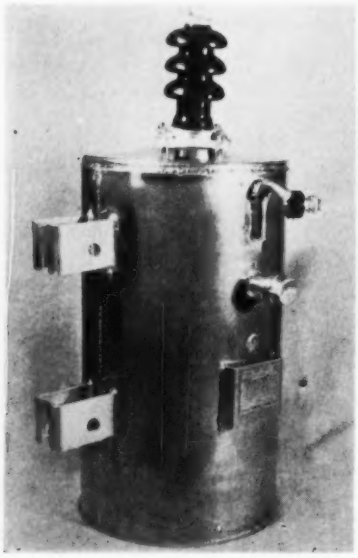
FULL VALUE FOR YOUR TRANSFORMER DOLLAR

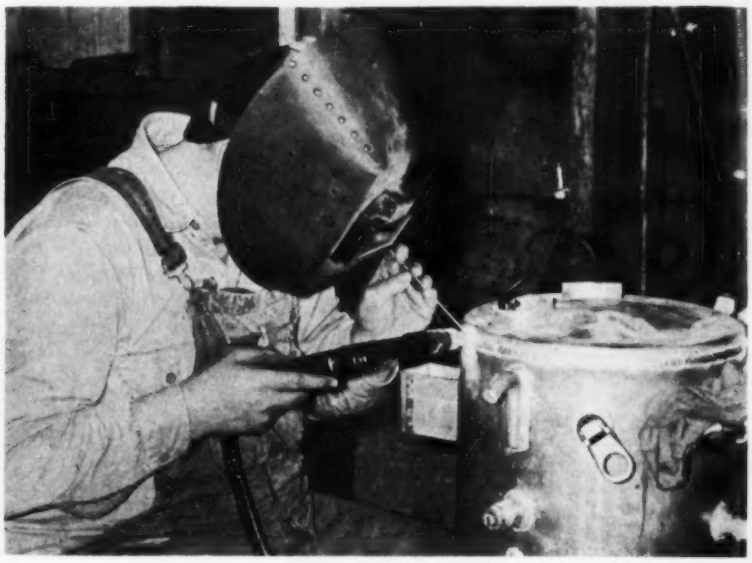


SUPERIOR DESIGN, FEATURES, AND PERFORMANCE of G-E transformers is typified by new pressure-relief device (above) and interchangeable transformer-circuit breaker bushings (below).

FASTER SHIPMENT through rapid processing of orders . . . computer design capability . . . repetitive manufacturing facilities.

COMPLETE SERVICE . . . application and systems engineers . . . installation engineers . . . of 50 conveniently located service shops.





—photos by All-State Welding Alloys Co

Welded Al Transformer Resists Corrosion

To combat corrosive seacoast atmosphere and prevent tank "breathing" Economy Transformer Co developed an all-welded aluminum tank transformer, reducing manufacturing costs below those of steel tanks. The transformers are lighter in weight and dissipate heat better than standard units, and no painting is required.

The tank cylinder is rolled from No. 5356 corrosion-resistant sheet aluminum, ⅛-in. thick. The top and bottom are cast of No. 4043 aluminum. Welding the sheet to the thicker casting was accomplished by carefully sanding and cleaning the aluminum before welding, and using tungsten inert-gas welding.

The coil is inserted in the tank and the top casting is welded on. Weather heads to protect connections are also welded on. A high-frequency ac welding system is used to stabilize the arc.

Previously, steel transformer cases rusted out in 3 to 5 years in the humid, salt-laden atmosphere.

The reduction in manufacturing cost is illustrated by the following comparison:

	Mild Steel	Aluminum
Net Weight of tank	150 lb	55 lb
Cost of welding rod	$13.65	$2.13
Labor	36.00	16.00
Cleaning and painting	15.00	none
Bolts and gaskets	10.00	none
Total, exclusive of basic material	$74.65	$18.13

Chlorine Harms Redwood Cooling Towers

Surface deterioration of redwood in cooling towers may be controlled within economic limits by proper treatment of circulating water. Tests conducted by the California Redwood Association indicate deterioration may be virtually eliminated by avoiding chlorine and using a non-oxidizing algaecide.

Moderate to severe surface deterioration and/or slight to moderate internal deterioration was found in 10 of 11 inspected towers where chlorine was used as the algaecide. In these towers, rates of surface deterioration increased with increased chlorination and increased pH. The combination of heavy chlorination and alkaline circulating water produced chemical white deterioration (delignification) while less chlorine and/or a less alkaline circulating water resulted in brown surface deterioration (decay).

If no algaecide is used, or if chlorination is limited to a residual less than 1 ppm and pH of 7 or less, surface deterioration usually will not shorten tower service life to less than 20 yr. Higher chlorine residuals and/or more alkaline circulating water may be expected to increase surface deterioration.

GO MODERN

with the world's newest mercury luminaires from General Electric

New beauty, efficiency, safety for every street and highway

GENERAL ELECTRIC

GO MODERN

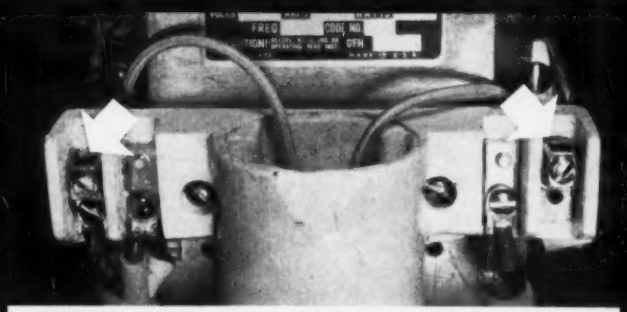
with General Electric's new mercury luminaires

New M-250

175 and 250 watt
residential and light-traffic streets

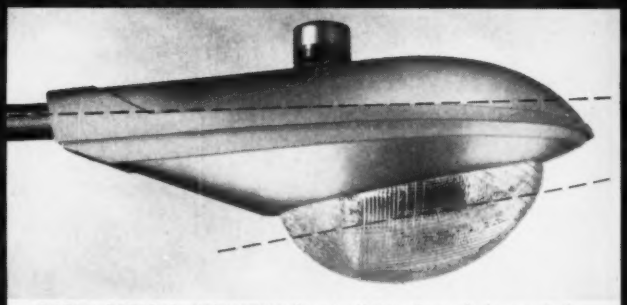
Get top efficiency, new modern

POWER PACK built-in ballast saves $50-75 per unit during installation—175- to 1000-watt sizes.

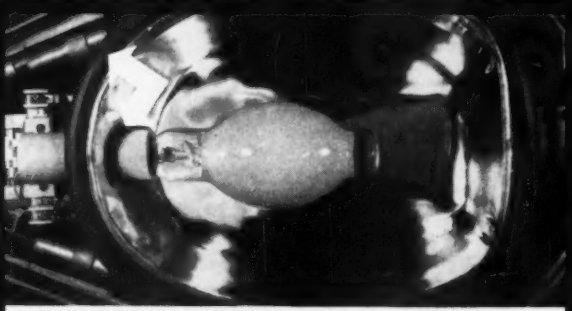


TERMINAL BOARD allows quick hook-up with two clamp-type screws; eliminates splicing, other interconnections.

UNIVERSAL SLIPFITTER easily adjusts for 1¼- or 2-inch brackets. Requires no additional parts.

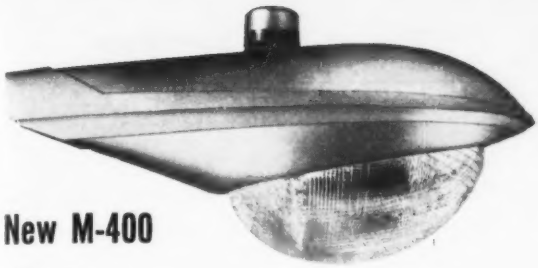


TILTED OPTICAL ASSEMBLY directs light where it is needed, contributes to graceful styling.



SEALED OPTICAL ASSEMBLY—silicone rubber gaskets block entry of bugs and dust, reduce cleaning.

UNIT PHOTOELECTRIC CONTROL with dependable new G-E cadmium sulphide cell locks on top of unit.



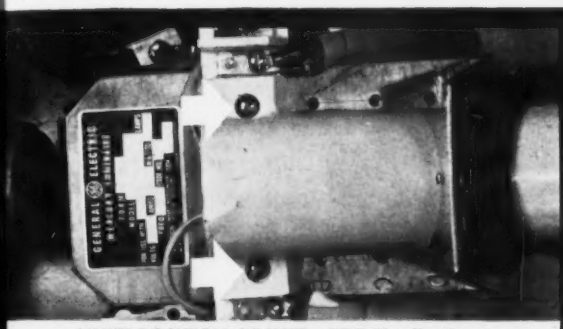
New M-400

400 watt
business and traffic streets, highways

New M-1000

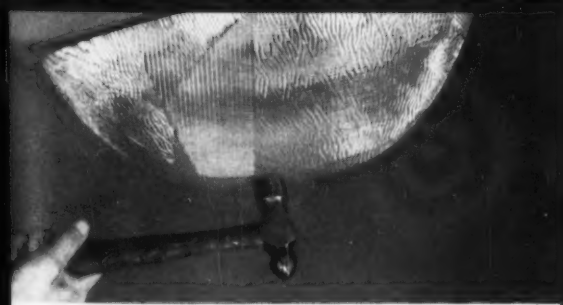
700 and 1000 watt
whiteways and shopping centers

styling, plus these extra values



MULTI-POSITION SOCKET—IES distribution types are easily selected by simple screw adjustment.

LAMP FLEXIBILITY—complete lamp selection—clear, white, color improved, 175 to 1000 watts.



ACRYLIC REFRACTOR on M-250 unit, heat-resistant glass refractors on other units, cut breakage.

Smart styling . . . unequalled efficiency . . . economical operation . . . all are yours with new General Electric mercury luminaires. And, for the first time you'll find ratings for every street and highway *in a single design family*. 100% designed by General Electric — with components engineered to work together—this new mercury line delivers these major user benefits:

Unparalleled photometric performance – Precisely contoured reflector and proven prism design give optimum light output and control.

Unequalled electrical efficiency – Built-in "Power Pack" ballast, first introduced by G.E., provides lowest "watts loss" in the industry; available in all ratings.

Wide flexibility–IES distribution types may be selected by simple movement of adjustable socket. Mount on either 1¼- or 2-inch bracket with universal slipfitter.

Low installation and maintenance costs–Easy access to all components, convenient two-connection pre-wired terminal board for wiring, unitized construction make installation simple. Long-life ballast, positive gasketing, heat-resistant glassware minimize maintenance.

Get full information from your General Electric Apparatus Sales Engineer or Agent today or use the coupon below.

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GENERAL ELECTRIC

Section A450-5, General Electric Co., Schenectady 5, N. Y.

Please send me free bulletins on the subjects checked below:

☐ New Mercury Luminaires, GEA-6943

☐ Cadmium Sulphide Photoelectric Control, GEA-6987

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Procurement & Products

BIDS ▶ **TVA charges of identical bids on standard items** of electrical equipment are sparking the federal grand jury hearings now set to begin in Philadelphia, July 15. Thus far the information subpoenaed from manufacturers refers only to bids made to TVA. But William Maher, the anti-trust attorney who is heading the nationwide inquiry, indicates he has been authorized to look at the electrical industry in general. This could mean that privately-owned utilities may be asked to furnish information.

Sen. Estes Kefauver (D-Tenn.) seems determined to go ahead with his proposed investigation of TVA charges. The grand jury hearing may put a damper on the Kefauver activity, but it is believed he'll give TVA officials a chance to air their charges anyway.

INVENTORY ▶ **Summer cuts in business inventory may not be so dramatic** as expected. Stocks for all industry have risen by $3 billion since last October's low, but sales have risen too. Total inventories on May 31 still stood some $3½ billion below their pre-recession peak, while sales were more than $3 billion above theirs. In other words, it would take an additional inventory buildup of about $7 billion to bring stock/sale ratios in line with the past decade.

COPPER ▶ **Copper prices to soften?** Engineering and Mining Journal's markets newsletter says U. S. copper fabricators have reduced their purchases with the view that their stocks are sufficient for a strike if the strike is not too long, and in anticipation of dropping prices.

ALUMINUM ▶ **Aluminum prices to rise.** Some analysts see the increase coming soon after a new labor contract is negotiated. The rise will come, they say, no matter how much or how little costs are increased by the new labor contract.

FLY ASH ▶ **Louisville G&E reports fly ash sells for $2 a ton** on the open market, but brings more when sold to the Army Corps of Engineers for special projects. The Kentucky utility is now selling about 3,000 tons a month. A government project in the area will require about 15,000 tons.

SUPPLIERS ▶ **Pennsylvania Transformer enters unit substation and low-voltage switchgear business** (see page 115) . . . Line Materials Industries builds short circuit laboratory for testing equipment up to 138 kv (see page 118).

News of Manufacturers . . . . . page 115
New Equipment . . . . . page 128
Readers Service . . . . . page 134

SOMETHING NEW UP IN THE BLUE!

**ONE-PIECE SPACER DESIGN—
NO MOVING OR MATING PARTS:**

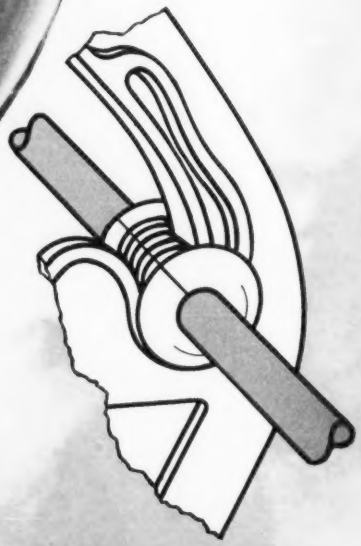
This design helps you in two ways:

(1) Smooth body permits self-washing . . . crevices that collect arc-causing contaminants are *eliminated.*

(2) The spacer is easy to install . . . no special line crews are necessary.

A lock ring securely fastens the spacer at the bottom. Once put in place and the phase conductor inserted, the lock ring is permanently attached.

Grommets are slit for easy application to individual conductors. Available in a number of sizes to fit any phase conductor or messenger diameter for 5-15KV systems.



COMPRESSION RINGS ON GROMMETS PREVENT "TRAVELING" ON THE LINES

An exclusive feature! Trimline's grommets have built-in compression rings to assure a snug cable-to-spacer fit. The proper distance between spacers is always maintained, because grommets prevent spacer from traveling.

ROME

TRIMLINE

ROME

TRIMLINE

PRIMARY DISTRIBUTION SYSTEM

NOW YOU CAN HAVE A MODERN AERIAL SYSTEM AT A MODEST COST!

Now spacer-type installations can be as *reliable* as they are *practical!*

This unique spacer design does it – part of the new Rome TRIMLINE Primary Distribution System! *There is no other spacer quite like it:*

It's all one piece – there are no cracks or crevices in which moisture or contaminants might collect to cause arcing.

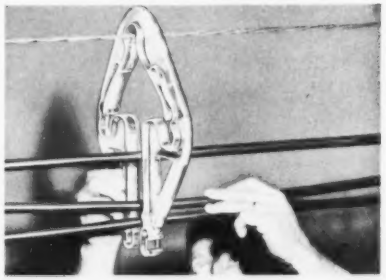
No nuts or bolts or special tools needed to install it. Even untrained personnel can do the job quickly.

Spacer completely encloses phase conductors and messenger to provide an extra measure of protection against storm damage.

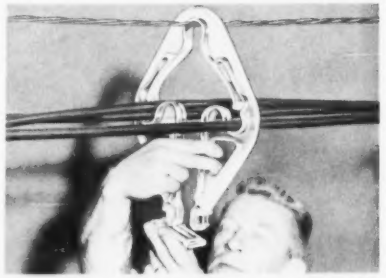
You can use a TRIMLINE system to gain these advantages:

1. Reduces tree-trimming costs in bad tree areas.
2. Provides storm-damage protection not provided by open-wire systems.
3. One spacer accommodates systems of up to 15KV.
4. Eliminates the need for additional crossarms.
5. Provides a positive means of phase identification.
6. Can be easily tapped and spliced.
7. Provides excellent voltage regulation due to lower reactance.
8. Phases can be easily added or removed.
9. Neat, trim appearance for residential areas.
10. Ease of maintenance.

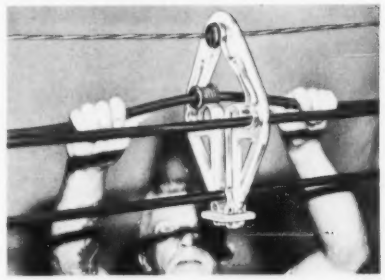
INSTALLS IN A JIFFY...WITHOUT NUTS AND BOLTS!



COLLECT conductors inside spacer.

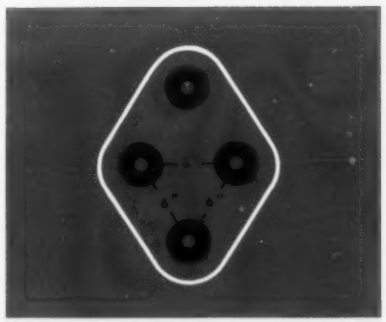


CLAMP it shut with lock ring. No nuts or bolts to slow you down!

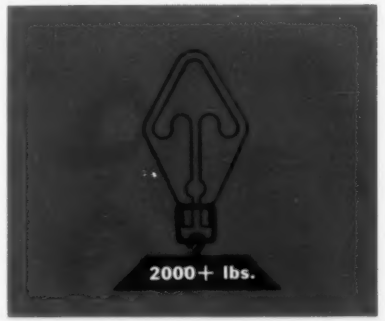


CLICK conductors (with grommets) in place – just a tug locks them tight!

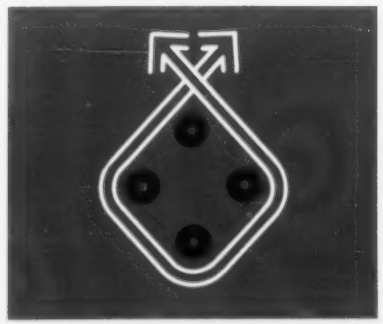
SEE HOW TRIMLINE SPACERS PROTECT YOUR SYSTEM



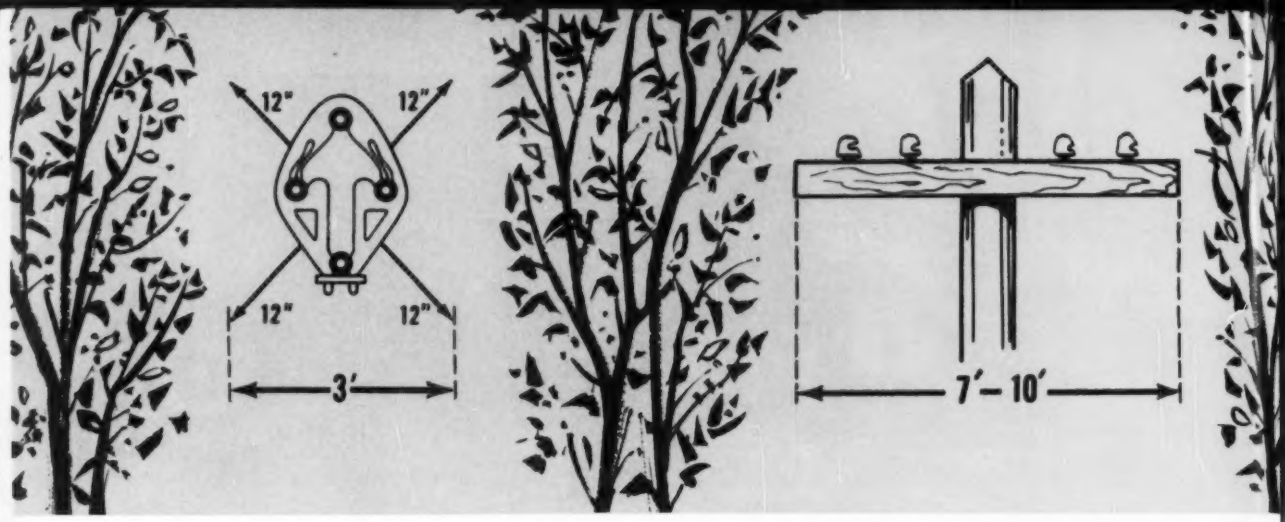
ARC- AND WEATHER-RESISTANT methyl methacrylate spacer is diamond-shaped. Phase conductors are spaced 6 inches apart on equilateral centers.



HIGH BREAKING STRENGTH. Extensive tests show the breaking strength of the TRIMLINE spacer to be in excess of 2000 pounds!

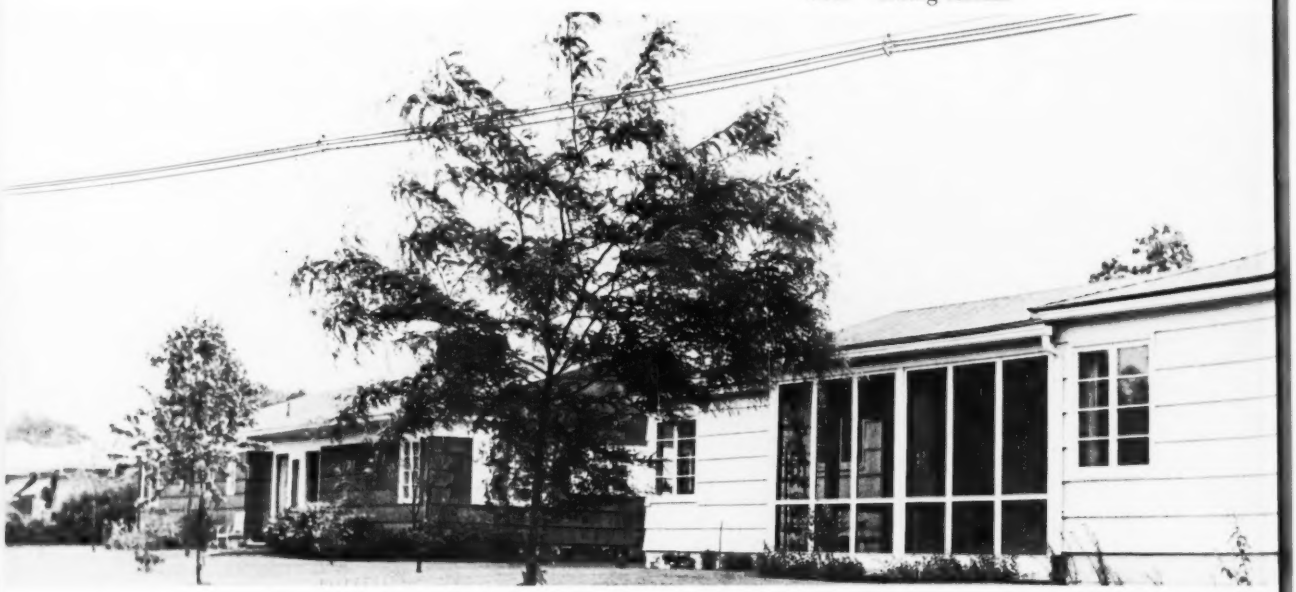


COMPLETELY ENCLOSES conductors. Messengers and phase conductors are *inside*, not *outside* the spacer itself. Conductors cannot work free of spacer.



REDUCE TREE TRIMMING

Because only 12 inches of clearance is necessary to accommodate a TRIMLINE spacer, you reduce your tree-trimming costs! The high-strength supporting messenger of the TRIMLINE System provides protection against falling branches – even trees – during storms.



TRIM NEAT COMPACT

Appearance of TRIMLINE is neat, compact – to please the townspeople. This modern system assures favorable public reaction to overhead circuits – especially in residential areas. And, because less tree trimming is required with TRIMLINE, you'll hear fewer complaints of "defacing" neighborhood shade trees.

ROME CABLE CORPORATION

Dept. 1, Rome, N. Y.

I want to know more about TRIMLINE! Please send me Bulletin RCP-791.

Name .....

Company .....

Title .....

Street .....

City ..... *Zone* ..... *State* .....

MEET THE MAN

WHO'S DEDICATED TO YOUR JOB

YOUR ROME CABLE SALESMAN

SEND FOR FREE BOOKLET!

This holds the answers to whatever remaining questions you might have about TRIMLINE – the practical *and* reliable method of overhead distribution. To get your copy, see your Rome Cable salesman, or clip and mail this coupon today!

ROME CABLE

CORPORATION

Litho in U.S.A.

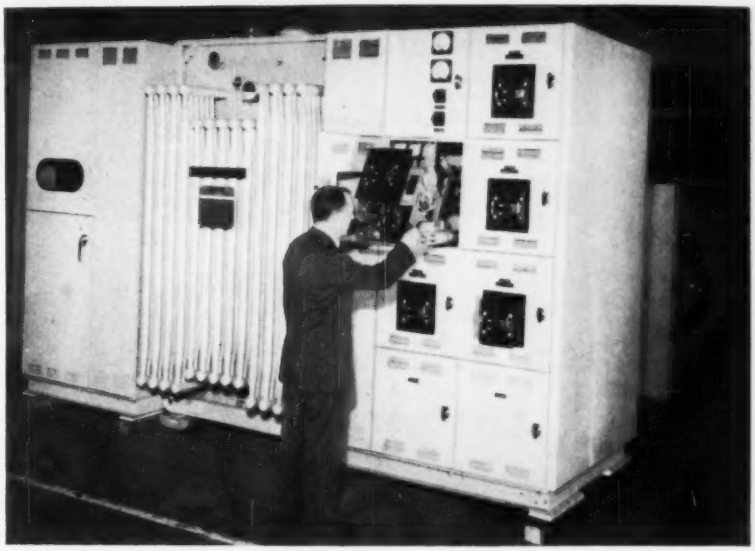
Pennsylvania Opens Secondary Sub Facility

A new department to manufacture and sell secondary unit substations and low voltage switchgear has been established by Pennsylvania Transformer Div, McGraw-Edison Co in Canonsburg, Pa. The substations made will include both indoor and outdoor types, in both articulated and integrated designs.

The articulated types range from 112½ through 2,000 kva; the integrated types, which are completely assembled at the factory, range from 75 through 500 kva. Normal primary voltages are from 2,400 through 13,800 v, with secondary voltages 480 v and below.

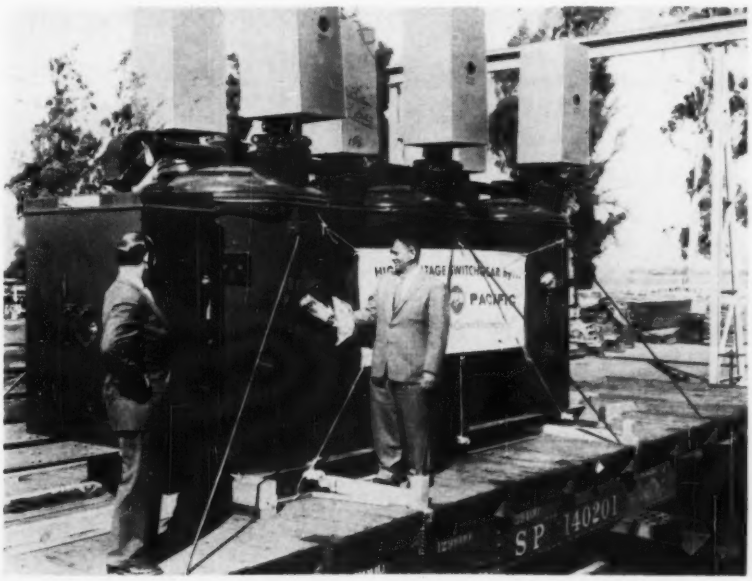
Secondary unit substations may be equipped with any of the several suitable transformers made by Pennsylvania. For indoor substations the sealed or ventilated dry-type, or askarel-filled transformers normally are used. Oil-filled transformers are used outdoors.

Special feature of Pennsylvania's drawout switchgear (see illustration) is its new tilt design. Switchgear is made to permit tilting of the breaker in its carriage to provide easy access for adjustment of trip settings.



Planning for new products to be developed by the company's new secondary unit substation and switchgear department is already underway, reports W. R. Swoish, Pennsylvania's vice president and sales manager. Among them will be a device to provide fast, reliable short-circuit protection for low-voltage circuits.

Federal Pacific Ships First Circuit Breaker from New Plant

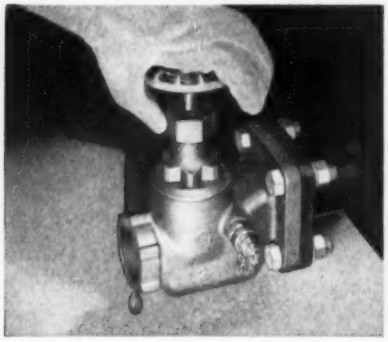


First oil circuit breaker shipped from Federal Pacific's new Santa Clara, Calif., plant is christened by city engineer as L. P. Shelley, FP's vice president and manager of the Pacific Switchgear Div looks on. The 115-kv breaker will be used on one of Pacific Power & Light's installations in Wyoming.

Federal Pacific has just completed a 7-year program to consolidate at the Santa Clara facility the activities of its Pacific Switchgear Div, previously carried on by three plants in the San Francisco area.

Among the many types of oil circuit breakers which will be manufactured there is the Type JHE 115-kv breaker with 1500-Mva interrupting capacity.

(*More Manufacturers News, p* 118)



FULL DRAIN VALVE, with auxiliary oil sampling valve, will drain the tank completely. Sampling is more accurate.

LIQUID ACTUATED THERMOMETERS. More accurate and dependable than thermometers actuated by a coiled bi-metal strip.

LEAK PROOF MOUNTING BOSSES. For wells and radiator drain plugs. Serrated surfaces make annular grooves in the copper gasket. Fully leak proof.

SMALL DETAILS--but they ADD UP to better performance... easier maintenance for

WAGNER POWER TRANSFORMERS

Even the smallest details get plenty of attention when Wagner builds power transformers. That's one of the *little* reasons Wagner Transformers give such long, completely dependable service.

Here are a few of the *big* reasons:

WAGNER TRANSFORMER WINDINGS, in general, are disk type for high voltage, and helical type for low voltage. They are best suited to obtain rigid bracings and provide low temperature gradients.

WAGNER LEADS AND TAPS are solidly supported for safe electrical clearance and mechanical strength by firmly positioned bakelite tubes or strong clamps.

WAGNER TANKS are designed and built to withstand operating pressures, with heavy structural steel end and side braces spaced to eliminate low frequency audio noises. All seams are made by a fully automatic welder.

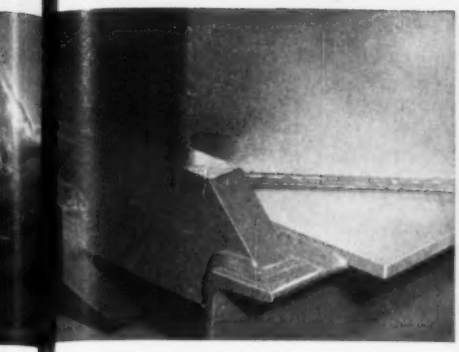
Consult Wagner about your next power transformer requirements. Your nearby Wagner Sales Engineer is at your service. Call him or write us.

Wagner Electric Corporation

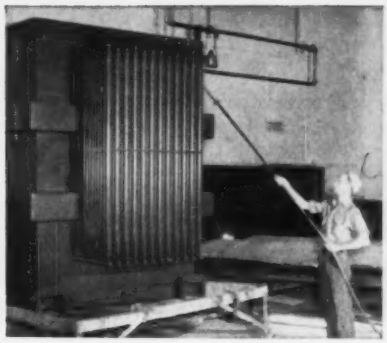
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

SERVING 2 GREAT GROWTH INDUSTRIES . . . ELECTRICAL - AUTOMOTIVE

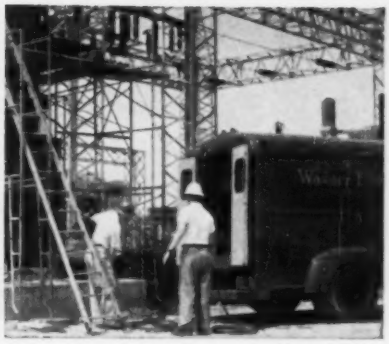
WT59-5



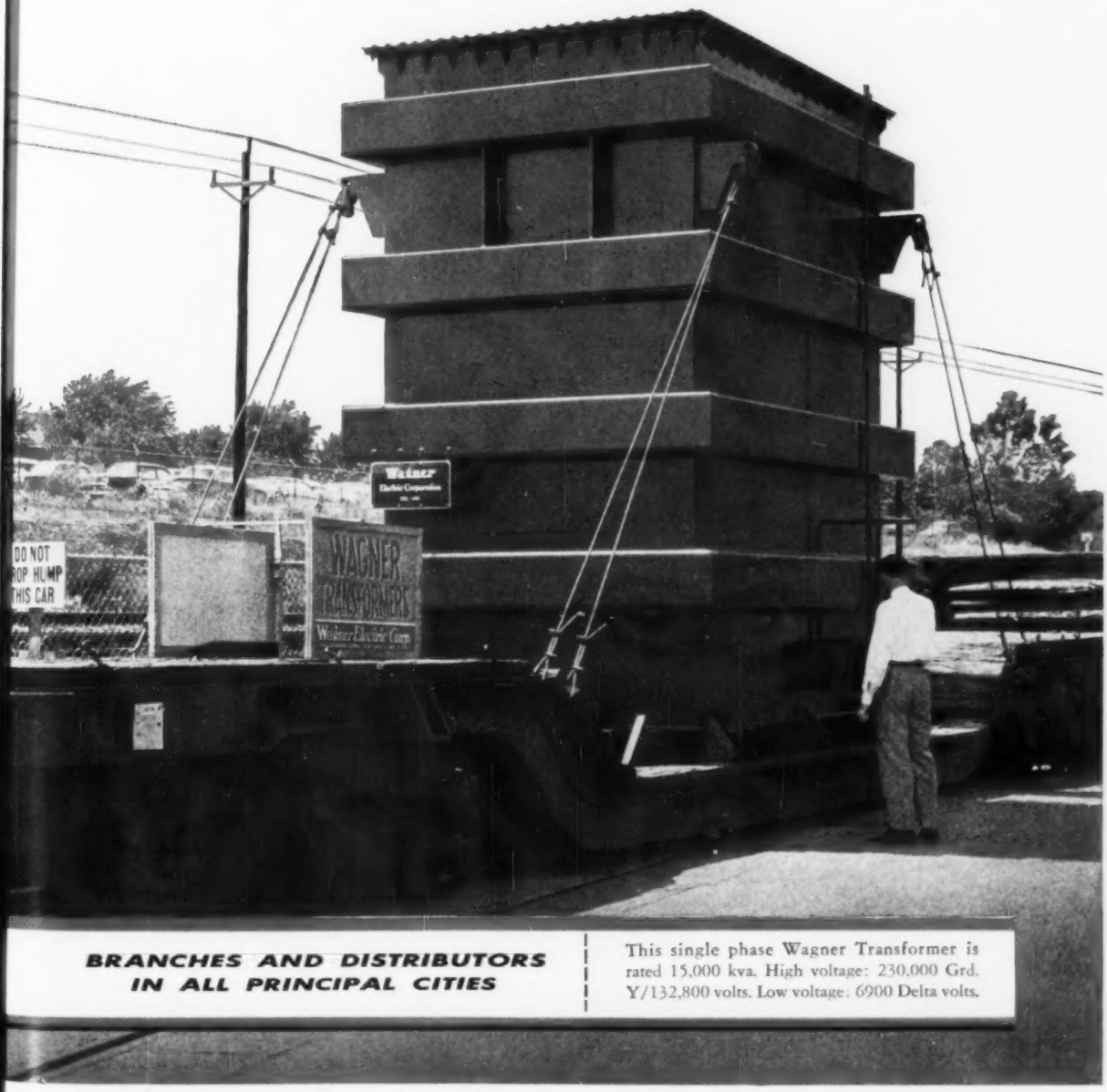
SMOOTH UNIFORM WELDS. Submerged electro-arc melt welds penetrate deeply, are exceptionally smooth and uniform.



LONGER LASTING FINISH. New formula "Sure Seal" tank finish withstands all temperature changes—is much longer lasting in corrosive atmospheres.



FIELD REPAIR SERVICE. Wagner substation transformer service trucks, manned by expert field repairmen, are available on schedule.



BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

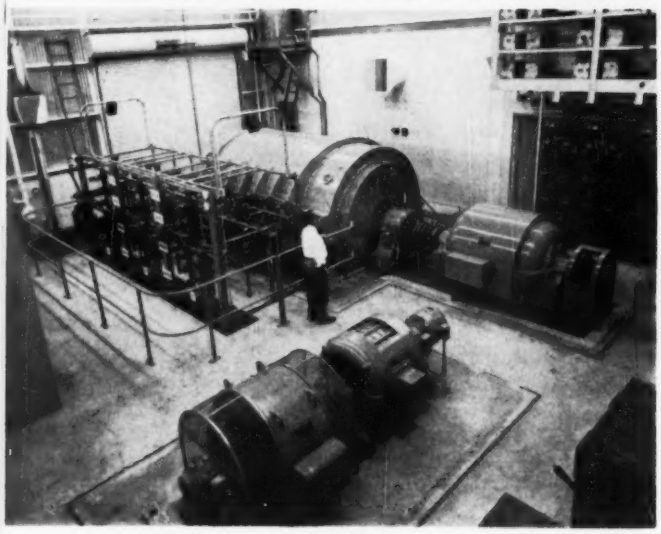
This single phase Wagner Transformer is rated 15,000 kva. High voltage: 230,000 Grd. Y/132,800 volts. Low voltage: 6900 Delta volts.

Line Material Expands Research Facilities

Opens Thomas Edison short-circuit laboratory in Wisconsin to test equipment to destruction (up to 138 Kv) in explosion-proof cells.

Personnel in control console conduct tests...

In these test cells. Voltages up to 138 kv . . .



Are supplied by this 60-cycle test generator

Line Material Industries has expanded its research facilities by building the Thomas A. Edison short-circuit laboratory for testing equipment up to 138 kv. According to Rodgers Wheaton, president, the new laboratory was added as a result of the company's realization of the electrical industry's growing need for test and research work.

Eventually, the new location in Franksville, Wis., will become an engineering center, also. The 134-acre tract with the laboratory in its center was chosen because of its remoteness from surrounding property lines. A 4½-mile tap of the Wisconsin Electric Power Co's 26-kv system was made, with the laboratory the only customer on it. These arrangements minimize the possibility of test activities disturbing the lab's neighbors and eliminate possibility of interrupting or disturbing their service on the line. The laboratory is located 25 miles southwest of the company headquarters in Milwaukee and 14 miles southwest of the South Milwaukee plant.

Power is supplied through a substation delivering 2,400 v for the special test generator and 440 v to supply building service. The test generator, which was moved from the company's South Milwaukee laboratory, is a 60-cycle unit with a 14-ton rotor, driven by an 800-hp, 2,300-v motor. The generator operates at 4,330; 7,500; 8,660; and 15,000 v. Short circuit capacity is in excess of 500,000 kva. Intermediate voltages are obtained by adjustment of the field circuit.

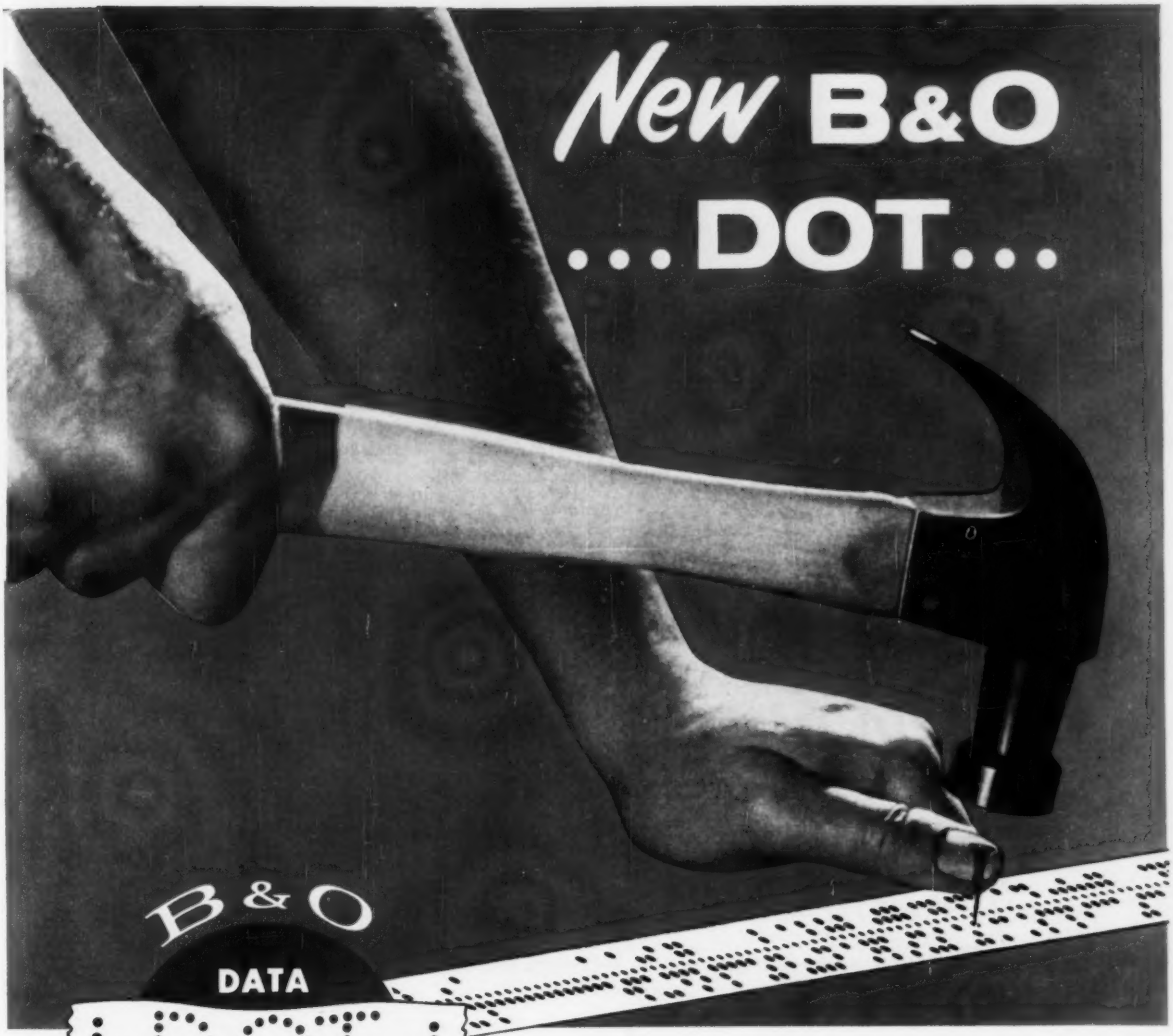
Test operations are controlled from a console in the central control room. Closed-circuit television provides observation of test areas from the booth. Viewers check to make sure no personnel are in the cell, then view results. An oscillograph, located next to the console, records each test; high-speed motion picture equipment permits a detailed study of the performance of specimens under test "after the fact."

Tests are conducted in three explosion-proof test cells. Heavily re-inforced monolithic concrete, 12-in. thick, was used for walls, ceilings, and flooring. From the test cells, large steel rolling doors open to the outside of the building (see illustration). Before each test in which products are tested to destruction, these doors are opened to vent high pressure in the test cell.

Test specimens are prepared in a large make-ready room, adjacent to the test cells. This cuts down the time consumed for each test considerably, permitting greater use of each test cell.

There are many advantages to having as many as three test cells, says Line Material. It is especially convenient if tests to destruction require the production of new parts before the test can proceed. Units tested are often development units, and either new units or parts have to be made for the specific application, which is time-consuming. The fact that a test set-up does not need to be dismantled saves much engineering and laboratory time.

(*More News of Manufacturers, p* 122)



Nails down freight information concisely and constantly for shipper satisfaction

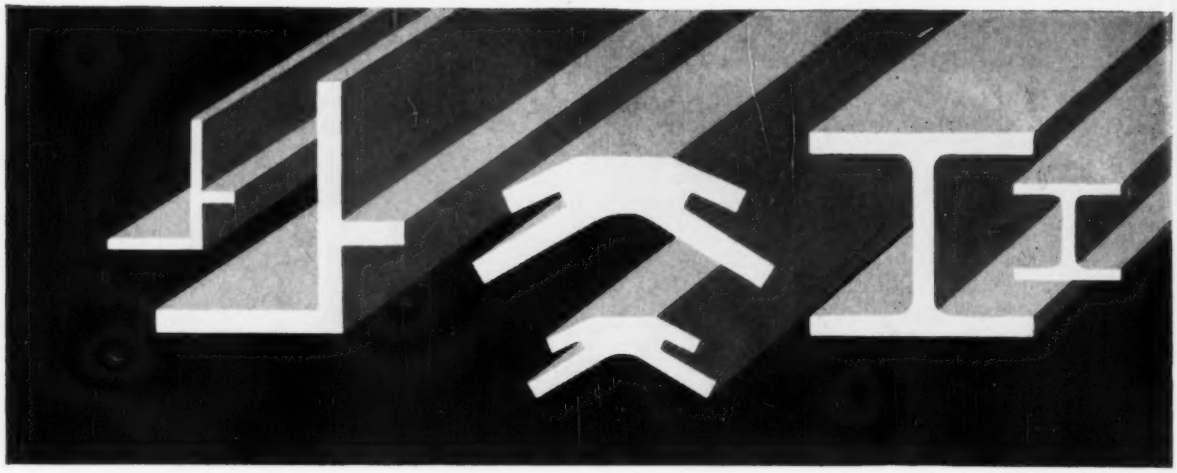
B&O's latest feat in modern railroading gives carload shippers faster freight tracing electronically. B&O . . . DOT . . . flashes terminal to terminal movements to system headquarters. From this one nerve center, the complete picture on car movement is relayed to all B&O traffic offices throughout the United States and Canada—24 hours a day.

Now B&O can help shippers' plans with even better information in a faster way. *Ask our man!*

B&O

BALTIMORE & OHIO RAILROAD

The line of SENTINEL Service—TIME SAVER Service—TOFCEE Service



now you can specify

SILVER PLATED

in almost any size or shape

Compare the cost savings of silver plated bus bar over copper

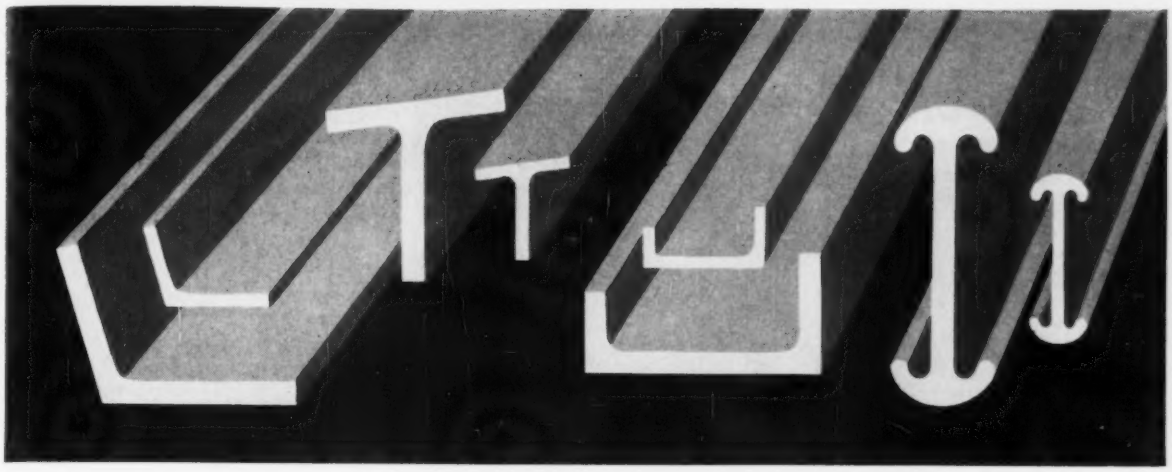
COMPARISON OF RECTANGULAR SILVER PLATED ALUMINUM BUS BARS WITH UNPLATED COPPER BARS

60 Cycle AC Ampacity (1) (Current Carrying Capacity)	Aluminum Alloy 6101-T62 30 C Rise	Copper 30°C Rise	Approx. Cost per Foot Silver Plated Aluminum 6101-T62	Approx. Cost per Foot Unplated Copper (2)
385	⅜" x 1"		$ .27	
395		¼" x 1"		$ .56
420	¼" x 1½"		$ .30	
925	⅜" x 3"		$ .82	
960	¼" x 4"		$ .80	
970		¼" x 3"		$1.64
1350	¼" x 6"		$1.19	
1405	⅜" x 5"		$1.37	
1485		¼" x 5"		$2.29

(1) Ampacity ratings based on standard indoor conditions. (2) Based on Feb. 6, 1959, copper prices

Added strength, size and shape design advantages of Reynolds Aluminum Bus Bar have very little effect on electrical conductivity. For example, a current load of 700 amperes requires a copper bar 2" x ¼" weighing just under 2 pounds per foot; Reynolds Aluminum Bus Bar carries the same load with a 2.8" x ¼" bar weighing only 4/5 pounds per foot. The result is a 60% savings in weight.

Other favorable properties of Reynolds Aluminum Bus Bar, compared with previous bus conductor materials, are an answer to electrical industry demands. Consider a ¼" x 4" aluminum bus 6101-T6 with 29,000 psi tensile in relation to a ¼" x 3" copper bus with 37,500 psi tensile and equal current capacity. With short circuit strength a direct function of tensile strength, 4 times 29,000 psi for Reynolds Aluminum Bus Bar indicates short circuit strength in excess of copper at 37,500 psi times 3. In addition, the smaller temperature coefficient of resistance for Reynolds Aluminum Bus Bar tends to improve its current carrying capacity; and the skin-effect resistance ratio is much lower than for copper.



BUS BAR (OR PLAIN BUS BAR)

from Reynolds

Here's a double story: design versatility plus silver plated bus bar economy. You can choose from Reynolds wide range of standard extruded bus bar shapes and sizes to meet a specific installation need without specifying oversize conductors because of intermediate size limitations. In addition, Reynolds can extrude special shapes and sizes in practically unlimited range to meet your most exacting requirements. This versatility permits designing to the minimum amount of metal needed for the current carrying job. The result is material costs lower than any other bus conductor.

And with Reynolds Silver Plated Bus Bar, you get a surface that permits higher operating temperature with bolted joints; simplified soldering. Silver plated bar also offers savings of 35 to 50% over bare or plated copper conductors. Thus you get optimum strength, high conductivity, simplified installations, design freedom—all at low cost.

Many extruded shapes because of sharp corners and shadow areas are not readily adaptable to a high quality silver plating. Such sections are subject to special inquiry.

REYNOLDS ALUMINUM

Watch Reynolds TV show—**"WALT DISNEY PRESENTS"**—every week on **ABC-TV**

For details and availability data, write today for the new brochure, "Reynolds Silver Plated Aluminum Bus Conductors", *Reynolds Metals Company, P. O. Box 2346-EL, Richmond 18, Virginia.* For assistance from Reynolds Engineering Service call your nearest Reynolds office or write to the above address.

C&D AutoCal*
Unitized Power-Pack

Popular mounting arrangement shows how *AutoReg*® Silicon Charger mounts inside switchgear cubicle door with controls projecting through. No manual switching or other adjustment required. PlastiCal® batteries need watering only once a year.

New C&D *AutoCal** *unitized* Power-Pack is specially designed for dependable switchgear tripping and control

Simple *AutoReg*® voltage regulated, current limiting Silicon Charger, paired with long-life PlastiCal® battery, assures high-capacity d-c power in compact package that is virtually *maintenance-free.*

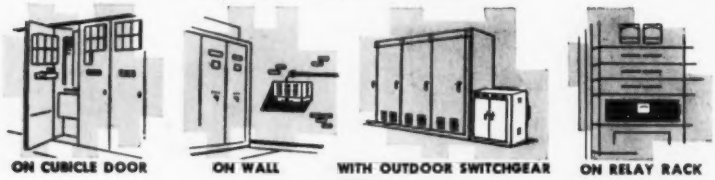
Now, utilities and industrial plants can guarantee an even greater margin of reliability and protection for switchgear and control equipment. The amazing new C&D *AutoCal unitized* Power-Pack always assures full power for tripping and control.

Here, for the first time, is a dependable, high-capacity power package *specially designed for tripping and control.* Virtually maintenance-free . . . with no manual switching or adjustment required . . . *AutoCal* provides many times the life of ordinary battery and charger combinations which may be *adapted* to this critical service.

AutoCal pairs the simple, compact *AutoReg* Silicon Charger with powerful PlastiCal lead-calcium-grid control batteries. A sudden demand for tripping power merely discharges the battery over a short period. While the breaker is tripped, PlastiCal supplies any necessary constant load current as might be required for the operation of pilot lights, holding coils, and similar requirements. Once the circuit is reclosed, *AutoReg* puts energy back into the battery at a high rate until it levels off at full charge.

Here's self-protected charging . . . no charger adjustment or maintenance . . . and 25-year-life PlastiCals only require watering once a year!

For full details—write for Bulletin AR-102 today!



ON CUBICLE DOOR | ON WALL | WITH OUTDOOR SWITCHGEAR | ON RELAY RACK

C&D

Since 1906

C & D BATTERIES, INC.
of Conshohocken, Pa.... Attica, Ind.

Sales and Service Offices in Principal Cities from Coast to Coast

Manufacturers of *Styrr-Clad*® Industrial Batteries • PLASTICELL* and PLASTICAL® Batteries for Communications, Control and Auxiliary Power • Producers of *AutoReg*® Silicon Chargers

**Trademark: AutoReg® Silicon Charger and PlastiCal® Battery.*

A-C Makes Dual-Purpose Load-Break Switch

Allis-Chalmers has introduced a frame-mounted, manually-operated load-break switch that incorporates the functions of a disconnecting switch and a circuit interrupter for interrupting transformer magnetizing and load currents.

Called Type LBS, the three-phase, single-throw, gang-operated switch is available either as an unfused or fused arrangement for housing in indoor cubicles, in 4,800 or 13,800 v capable of interrupting 400 or 600 amp normal load, with momentary values up to 20,000 and 40,000 amp, respectively. The switch has a quick-break blade and arc chute interrupter.

The switch is suitable for transformer primary switching in unit substations, for service entrance switching, for throw-over from preferred to emergency circuits, for loop circuit sectionalizing, and for isolating plant feeders. It can be combined with power fuses to provide substation protection and switching, sectionalizing and protection of branch distributing feeders, also short circuit protection on primaries of industrial substations.

Orders Increase for GE Single Tank OCB's

General Electric has received a marked influx of orders for single tank circuit breakers for sub-transmission voltage, 14.4 through 46 kv.

Since introducing its new all-in-one tank breaker last fall, GE's high voltage switchgear department has recorded orders for more than 100 units. A corresponding number of inquiries for more information has been received from utilities.

This increase in orders and wide interest shown in the single tank breakers is attributed by G. L. Roark, department manager of marketing, to the utility industry's trend to modernize distribution systems, while reducing maintenance costs—necessitating a change in breaker design. Typical of utilities which are revamping their systems is Potomac Edison, which has ordered 17 of the new Type FKA-34.5-1500, 1200 amp single tank breakers.

(*More Manufacturers News, p* 125)

another G-E '8000' development

GENERAL ELECTRIC ANNOUNCES . . .

New Custom '8000'* Motors

PROJECT '8000' . . . a major General Electric program of research, redesign, advanced manufacturing and improved customer service on A-c motors 150 to 6000-hp.

*Trademark of General Electric Co.

CUSTOM DESIGNED . . . New General Electric Custom '8000' motors are built specifically to meet your requirements. Selecting from specially designed enclosures, advanced insulation systems, custom-designed end shield and bearing constructions, and more than 15 custom-designed accessories—plus a countless number of electrical designs—General Electric engineers will create a motor to meet exacting needs, provide initial and continuing economy, and give long, reliable service. Turn page for features of new Custom '8000' motors.

NEW CUSTOM '8000' MOTORS GIVE TOP PERFORMANCE WITH LESS MAINTENANCE . . . HERE'S WHY

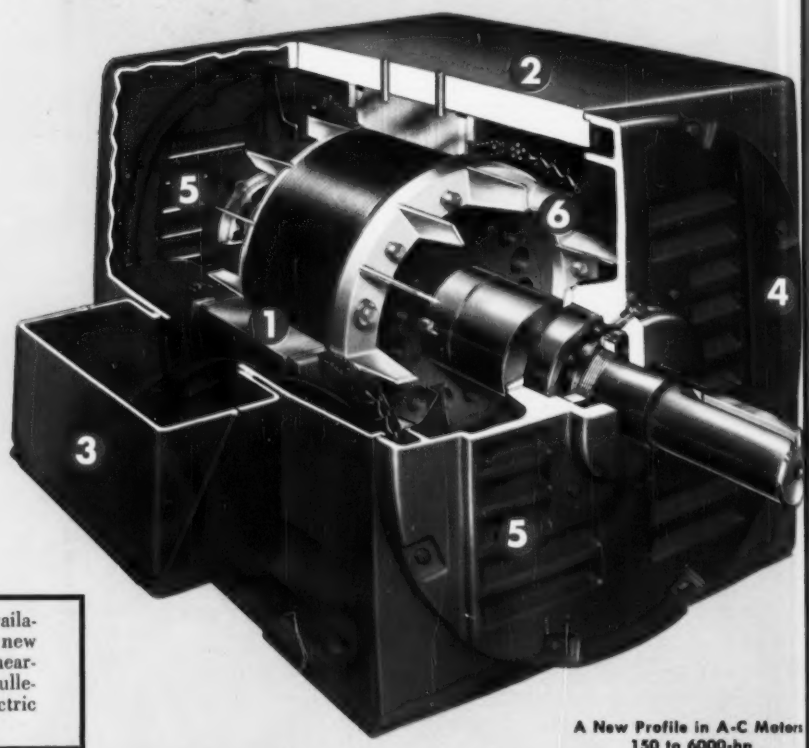
GENERAL ELECTRIC

FROM GENERAL ELECTRIC . . .

another G-E PROJECT '8000' development

NEW Custom '8000'* Motors Give Greater Reliability Require Less Maintenance

1. **LONGER INSULATION LIFE**—Pre-wound core allows closer quality control and gives longer insulation life through improved varnish impregnation or silicone rubber encapsulation.
2. **BETTER CONSTRUCTION**—Cast iron frame withstands 20G simulated transportation shock tests; resists corrosion.
3. **FASTER INSTALLATION**—Conduit box has up to 3 times volume of ordinary boxes; lifting lugs, cast to frame, hold up to 12 times motor weight.
4. **EASIER MAINTENANCE**—Flat end shields are more adaptable to addition of accessories or modifications; are lighter—easily handled by one or two men.
5. **BETTER COOLING**—Double-end ventilation, new duct design and louvred air openings provide more efficient air distribution through motor, reduce hot spots.
6. **LOWER NOISE LEVEL**—Sound power has been cut up to 50% by redesigning frame sections, rotor fans, air deflectors and intakes.



A New Profile in A-C Motors
150 to 6000-hp

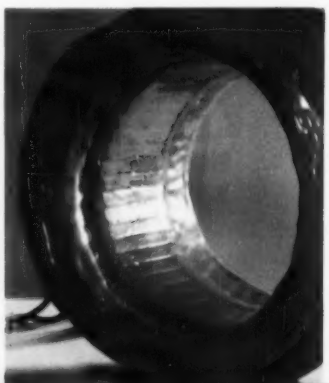
FOR COMPLETE INFORMATION and availability dates about General Electric's new Custom '8000' motor line, contact your nearby Apparatus Sales Office, or write for bulletin GEA-6865, Section 884-2, General Electric Co., Schenectady, N. Y.

NEW *Polyseal** SILICONE RUBBER INSULATION SYSTEM IS AVAILABLE ON CUSTOM '8000' MOTORS

Silicone rubber used in Polyseal insulation systems is a product of General Electric's Silicone Products Dept., Waterford, N. Y. . . . a leader in research, development, and manufacture of silicone materials. Supported silicone tape is a development of General Electric's Insulating Materials Dept., Schenectady, N. Y. Combining silicone rubber with dacron-glass supporting materials is a major engineering advancement, giving this material both the mechanical and dielectric strength required for use as a motor insulation. Polyseal insulation systems are available *only* on General Electric motors. Medium AC Motor & Generator Dept.

FORM-WOUND MOTORS

Polyseal supported silicone rubber insulation system provides greater mechanical, thermal, voltage and environmental endurance than unsupported silicone rubber. Glass fabric materials are imbedded in each layer of silicone tape, which, after coil wrapping is vulcanized under heat and pressure to seal the system against moisture and contaminants. General Electric form-wound open motors with Polyseal insulation system can be used in some severe atmospheres formerly reserved for totally-enclosed motors.



RANDOM-WOUND MOTORS

Polyseal silicone insulation system offers greater flexibility and better heat transfer than existing encapsulations . . . it operates effectively from —90C to 200C and will not crack under excess thermal cycling or severe moisture. After receiving G.E.'s standard random-wound insulation treatments, Polyseal insulation is applied to stator and end turns, completely sealing windings with a thin, waterproof, inert covering which protects against extreme moisture, most chemical fumes, dust and corrosion.

*Trademark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

MANUFACTURERS BRIEFS

Allis-Chalmers has acquired Tractomotive Corp, which will be operated as the Deerfield A-C works; also Lakefield Mfg Co, fabricator of construction machinery parts. The latter will be known as the Wauwatosa Works and operated in conjunction with the new Deerfield plant . . . **Hagan Chemicals & Controls** reports 1st six months' sales volume for 1959 is about 8% above that of the same period in 1958. Total sales for '58 first half of $13,486,995 is topped by $14,500,000 for '59's first half year; net income of $559,518 for similar '58 period is exceeded by $725,000 in '59 . . . **LeTourneau-Westinghouse** finds the best heat insulator coatings for armature windings in electric motors is a phenolic resin base material. The material is called Ray-BOND R-84706, product of Raybestos-Manhattan, Inc, Bridgeport, Conn. The protective coating first tried was a thermosetting varnish, then one coat of the Ray-BOND was used in conjunction with it. Further testing at the company's Toccoa, Ga., plant proved that application of two coatings of the Ray-Bond was most effective, maintaining its strength up to 600F, having very low water absorption and excellent bonding strength to the insulated wire.

Aerotec Industries was formed July 1 from merger of the following Conn. firms: Prat-Daniel of South Norwalk, Aerotec Corp and Thermix Corp of Greenwich, and Aerotherm Corp of Bantam, Conn. The division of the new combine which designs and manufactures electrical precipitators, blowers, fans, and other heavy industrial products is located at the Greenwich and South Norwalk plants . . . **Allis-Chalmers** receives a $1.6 million contract for a 95,000-kw generating unit for Hoover Dam. It is the 17th and last for the site, as well as the largest: the others are 82,500 kw . . . **Indiana Steel Products** and **General Ceramics** merge, to operate as separate divisions of a joint company. Indiana produces permanent magnet materials; GC makes ferrite and ceramic products, also memory de-

(*Continued on page* 126)

WHAT HAPPENED HERE?

The price was low, and the controls he bought for the street lighting project met minimum specs.

But*..... Performance? *Unreliable.

Overall cost? *Far above expectations.*

Before *you* decide on *any* automatic light control, remember:

LUMATROL MODEL T IS THE ONLY CONTROL THAT IS TUBELESS...CONDENSER-LESS ...RECTIFIER-LESS...AND STILL HAS RESERVE CONTACT CAPACITY...PLUS SUFFICIENT TIME DELAY TO PROTECT YOUR MERCURY VAPOR LIGHTS!

Patented Lumatrol cover permits light sensitive cell to face up for zenith sensing. No orientation!

Thirty-thousand installations prove 99.5% reliability.

WRITE FOR FULL INFORMATION

MANUFACTURED UNDER PATENTS AND PATENTS PENDING BY

MICRO-BALANCING, INC., HERRICKS ROAD, GARDEN CITY PARK, L.I., N.Y. • PI 6-0851

IN CANADA: J. R. KEARNEY CORP. • BOX 270, GUELPH, ONTARIO

The CF&I Image assures quality

Galvanized Steel Strand

for Guy, Messenger & Ground Wires

The CF&I Image—giant symbol of dependable steel products—contributes to the ever-expanding industrial growth of America. And where telephone or utility lines spring up, you'll find the CF&I Image—for in the electrical and communications industries he stands for top-quality guy, messenger and ground wires.

To prevent pole leaning and power line sagging, use CF&I Galvanized Steel Strand. Made to customer specifications or to ASTM specifications A-122 or A-363, the steel strand is quality-controlled throughout every stage of production. That's why utilities rely on CF&I Galvanized Steel Strand to stand up under the most rugged conditions.

When you need strand, see your nearby CF&I representative or local distributor for complete details on CF&I Galvanized Steel Strand.

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CF&I STEEL

GALVANIZED STEEL STRAND

THE COLORADO FUEL AND IRON CORPORATION

In the West: THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings Boise • Butte • Denver • El Paso • Ft. Worth • Houston • Kansas City • Lincoln • Los Angeles Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco San Leandro • Seattle • Spokane • Wichita

In the East: WICKWIRE SPENCER STEEL DIVISION—Atalnta • Boston • Buffalo • Chicago Detroit • New Orleans • New York • Philadelphia

CF&I OFFICE IN CANADA: Montreal • CANADIAN REPRESENTATIVES AT: Calgary • Edmonton Vancouver • Winnipeg

Manufacturers Briefs

(*Continued from p* 125)

vices for data-processing equipment. Stearns Magnetic Products is a division of IS; Advanced Valuum Products is a wholly-owned GC subsidiary.

Allis-Chalmers has a newly designed runaway speed limiter for Kaplan turbines which permits rapid change in blade angle to reduce rotational speed due to water flow. Blades go to maximum pitch position if an overspeed condition exceeding a preset value occurs, or if the turbine is accidentally disconnected from the load. Maximum off-cam runaway speed of Kaplan turbines is, in general, 2.5 to 3.0 times normal speed . . . **General Electric** has introduced a new line of mercury vapor street and highway luminaries, Type M, and a new photoelectric control. The luminaries are available with "Power Pack" built-in ballasts if desired and come in three basic units, M-250 (175 or 250-watt); M-400 (400-watt), and M-1000 (700 or 1000-watt). Rapid, simplified installation is a feature: a multi-position socket adjustable in the field for the lamps; an adjustable clamp in the slipfitter permitting units to be installed on either 1¼ or 2-inch brackets; the control is plugged into receptacles on the luminaries and locked into position with one twist. GE believes from $50 to $65 savings per pole may be realized through this type of installation.

The Dyson Corp, New York holding company, announces acquisition of Esterline-Angus Co, Indianapolis, manufacturer of graphic recording instruments, used in power plants. Under the new ownership, substantial expansion is planned. No changes in executive personnel are contemplated. Dyson also owns Hubbard & Co, James R. Kearney Corp, and Electrical Engineers Equipment Co . . . **General Electric** announces a reduction in the list prices of certain street and highway-lighting equipment. Decreases include 5% on filament luminaires, 10% on fluorescent street lighting luminaries, to 15% on others.

(*More Products & Procurement p* 128)

KELLOGG'S K-WELDING IN THE FIELD KEEPS PACE

Once restricted to shop fabrication, K-Weld® has recently been successfully adapted by Kellogg to meet the severest specifications for welding high-pressure-temperature power piping in the field. Currently it is being used in the erection of supercritical piping systems for some of the country's leading steam-electric utilities.

Unique among field welding techniques, K-Weld assures complete penetration of the root bead and a highly uniform internal contour *without backing rings*—through the use of controlled inert gas pressure inside the pipe. The technique can be used on pipe of any type or size during shop fabrication or in the field.

Kellogg welcomes inquiries on K-Weld and its complete service to the power piping industry from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment. An introduction to this service may be obtained by writing for Kellogg's new 12-page booklet, "The Eddystone Story".

As welder lays K-Weld root bead, his assistant controls the pressure of the inert gas. Using this technique, the root bead can be made slightly convex, flush or concave, and the weld deposited with a highly uniform internal contour. No backing rings are needed.

Fabricated Products Sales Division

THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.

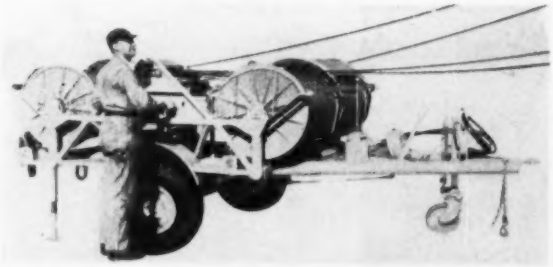
A SUBSIDIARY OF PULLMAN INCORPORATED

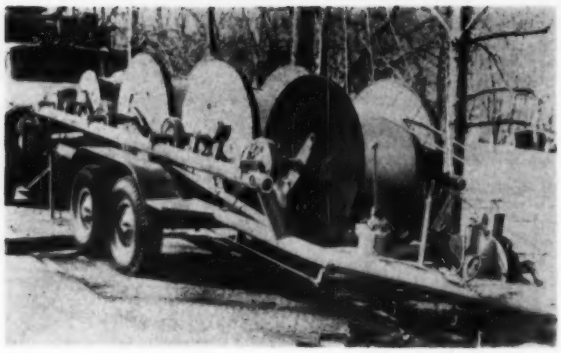
The Canadian Kellogg Co., Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., Buenos Aires • Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

®Registered trademark of the M. W. Kellogg Company, Process Patented

(For further information refer to Reader Service on page 134)





Tensioning Equipment . . .

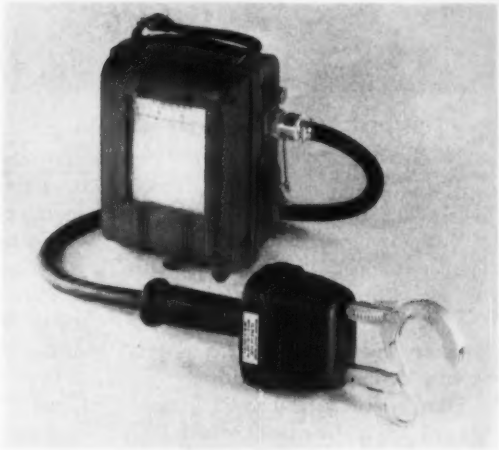
. . . consists of two pieces of equipment called a "Puller" and a "Tensioner." "The Puller" is a multiple-reel pulling trailer with four reels powered by a 30-hp air-cooled engine mounted on a trailer chassis. "The Tensioner" is a multiple-reel stringing trailer that will pay out four reels of conductor under 2,000 lb constant tension. Ropes from the puller are strung across poles to span half a mile. The ropes are then attached to the conductor. The brakes on the conductor reels are set at the proper tension, and the engine on the puller is started. Over half a mile of conductor can be pulled in less than 60 min.

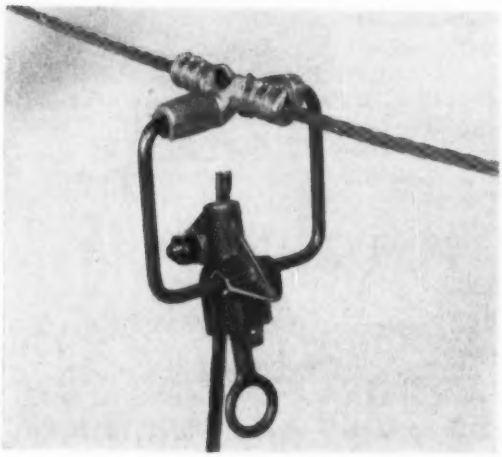
Truck Equipment Corp, 3963 Walnut St, Denver 5, Colo.

13.2-Kv Transformer . . .

. . . extends applications of GE's portable CH-7 and CF-7 hook-on recording volt-ammeters. Supplied as standard equipment with both of the strip-chart recorders, the butyl-molded transformer permits accurate load surveys on insulated and uninsulated distribution lines having voltages up to 13.2 kv line-to-line without the inconvenience of opening conductors or interrupting service.

General Electric Co, Schenectady 5, N. Y.



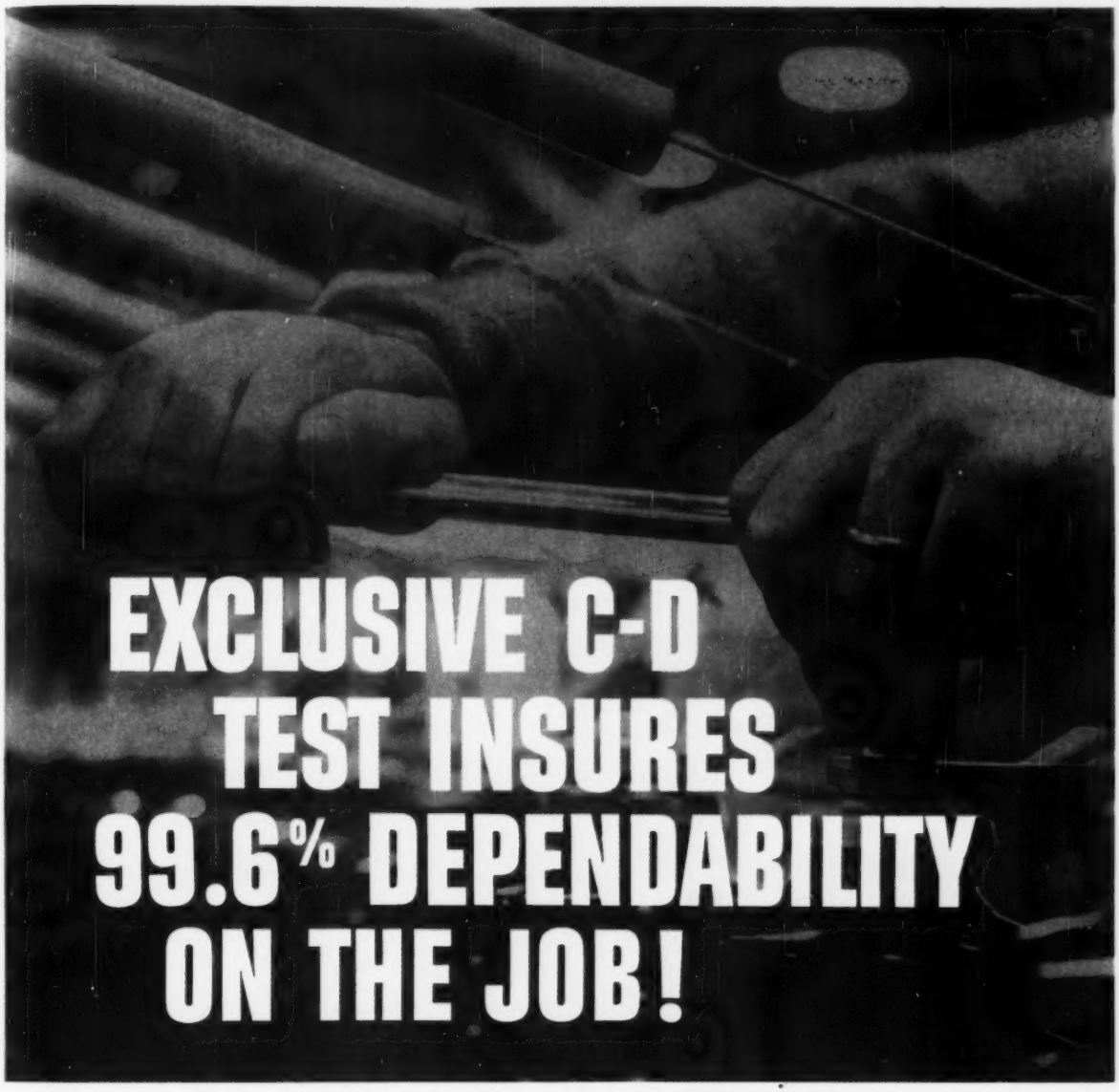


Bail Clamps . . .

. . . feature a bail positioned at right angles to the main-line conductor. This provides ample crimping-tool working room during installation, gives more line-to-line clearance when a tap is installed on or removed from the bail, and dampens conductor vibration. The four-clamp series gives a main-line conductor range of No. 4 ACSR or No. 2 solid through No. 2 ACSR.

A. B. Chance Co, Centralia, Mo.

(*More New Equipment on page* 130)

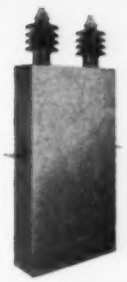


EXCLUSIVE C-D TEST INSURES 99.6% DEPENDABILITY ON THE JOB!

THIS PAIR OF HANDS reaching through a row of fuse links, is checking tightness of electrical connections on a series of C-D shunt capacitors. The hands belong to one of the many skilled C-D inspectors who make sure C-D capacitors are everything you want them to be...reliable, long-lasting and maintenance-free.

Before coming to this particular pair of hands, the capacitors were subjected to capacitance, leak, dielectric and energization tests. The energization test—*exclusive* with C-D—puts the units through an hours-long, full-voltage "heat run" that duplicates the same conditions the capacitors meet in the field. The capacitors aren't shipped unless they pass. That's why C-D capacitors deliver an unbeatable *99.6%-sure performance on the job.*

Invest your purchasing dollar in *internal* quality—the only place it really counts. See a C-D sales engineer today. Write to Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.



15, 25, 33.3, 50 and 100 KVAR capacitors for every application, with lowest dielectric unit stress, highest major insulation level and power losses considerably below the NEMA limit of 3.33 watts/KVAR.

Consistently Dependable

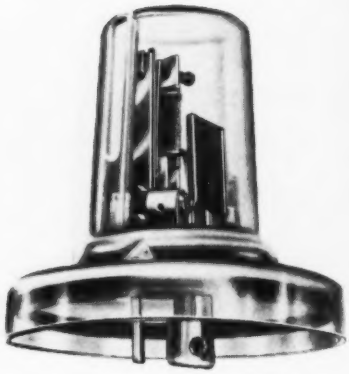
CORNELL-DUBILIER

POWER-FACTOR CAPACITORS

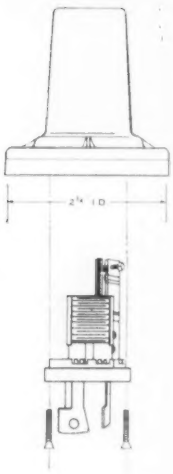
THE FIRST AND ONLY

2 component

PHOTOELECTRIC OUTDOOR LIGHTING CONTROLS



2 components switch and cell



The field designed PMC control is rugged, dependable and inconspicuous. PMC engineers originated and pioneered the simplified tubeless photocontrol circuitry utilizing an integrating relay directly operated by a CdS photoconductive cell. Multi-component unreliability has been eliminated by PMC. Proven by more than 130,000 field installations.

FEATURES:

- Designed to EEI-NEMA Standards TDJ-148
- Large Area CdS Photoconductive Cell
- Component Protection — Lightning Arrester
- Small Size—Height 2 1/16", Base 2¾" I. D.
- Ambient Temperature Compensation — −40°F to +170°F
- Time Delay
- Tubeless
- Fail-Safe Operation

A complete line of Precision Photoelectric Lighting Controls is available in 120V or 240V models to meet your every need.

PMC

PRECISION MAGNETIC CONTROLS, INC.

233 CHESTNUT STREET, RIDGEWOOD, NEW JERSEY

FOR COMPLETE TECHNICAL INFORMATION *write for* NEMA SPECIFICATION BULLETIN 459 AND FOR BULLETIN 460.

Plastic-Coated Covers . . .

. . . for distribution transformers are now available on all pole-type units having cover-mounted bushings. The Plasticlad plastic-coated parts are standard on all units of this type rated from 5 through 333 kva. The plastic coating is on main and hand-hole covers, eye bolt and hand-hole bolt to provide insulation against line-lockout from birds and squirrels. Covers have excellent resistance to corrosion and abrasion.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Fluorescent Fixture . . .

. . . for street and highway lighting emits good color rendition with low glare factor. Called the "Broadstreeter", the aluminum, fully-weatherproofed fixture is self-contained, ready for mounting and wiring. It is available in 4 and 6-ft sizes, designed for high wattage and standard high output lamps. It operates on 110-125 v, but may be ordered for other voltages.
Metalcraft Products Co, Inc, Philadelphia 35, Pa.

Hot Stick . . .

. . . of telescoping type has new snap action locking mechanism. Called the Extendo Locking Hot Stick, the device is available in

(*Continued on page* 135)

2.....ways to get to the top

1. **Send in the coupon below.**

2. **Receive your own copies of Electrical World at home each week.**

It'll put you on top of the "Routing Slip," on top of industry developments and who knows, maybe someday on top of the heap. The cost: $6 for 52 issues. No need to send money now.

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HOW THE ALUMINUM IN K/W INTERLOCKED ARMOR CABLE SAVES YOU MONEY...SPEEDS YOUR JOB

K/W 3 Conductors Interlocked Armor Cable Spec. 808-S vs. 3 Copper Cdrs. in Steel Conduit
COST AND WEIGHT COMPARISON—1000 FT.

600V RHW 75°C RUBBER 3 Copper Cdrs. in Steel Conduit							600V ALUMINUM INTERLOCKED ARMOR Aluminum Conductors, 90°C, Butyl Insulation						SAVINGS WITH ALUMINUM				
		CONDUIT															
Wire Size	Amps.*	Trade Size In.	O.D. Inches	Area Sq. In.	Total Wt.—Lbs.	Total Cost—$	Wire Size	Amps.**	O.D. Inches	Area Sq. In.	Total Wt.—Lbs.	Total Cost—$	% Bonus Ampacity Alum. over Copper	SAVINGS (1) $	%	Weight Savings Lbs.	Space Savings %
2	115	1¼	1.66	2.17	2,860	903.	1	120	1.44	1.63	850	713.	4.3	190.	27	2,010	25
1	130	1½	1.90	2.82	3,570	1,155.	1/0	135	1.53	1.84	960	806.	3.8	349.	43	2,610	35
1/0	150	2	2.38	4.44	4,660	1,457.	2/0	160	1.63	2.07	1,115	926.	6.7	531.	57	3,545	53
2/0	175	2	2.38	4.44	4,960	1,609.	3/0	180	1.74	2.38	1,285	1,093.	2.9	516.	47	3,675	46
3/0	200	2	2.38	4.44	5,350	1,814.	4/0	205	1.87	2.74	1,550	1,265.	2.5	549.	43	3,800	38
4/0	230	2½	2.88	6.51	7,730	2,508.	250	230	2.04	3.27	1,840	1,522.	0	986.	65	5,890	50
250	255	2½	2.88	6.51	8,190	2,883.	300	255	2.16	3.66	2,080	1,751.	0	1,132.	65	6,110	44
300	285	2½	2.88	6.51	8,700	3,171.	350	285	2.27	4.04	2,325	1,870.	0	1,301.	70	6,375	38
350	310	3	3.50	9.62	10,860	3,752.	400	305	2.37	4.41	2,560	1,998.	–1.6	1,754.	88	8,300	54
400	335	3	3.50	9.62	11,370	4,053.	500	355	2.56	5.14	2,990	2,260.	6.0	1,793.	79	8,380	46
500	380	3	3.50	9.62	12,390	4,748.	600	395	2.79	6.11	3,545	2,615.	3.9	2,133.	82	8,845	36
700	460	3½	4.00	12.57	15,930	6,459.	750	455	3.02	7.16	4,175	3,151.	–1.1	3,308.	105	11,755	43

* Based on 1956 N.E. Code ** 90°C Conductor—40°C Ambient. Note—Comparison of 75°C RHW and 90°C Butyl K/W Spec. 107. Current prices, 4-29-59.
(1) Savings based on increased cost of copper and steel over aluminum cable. Weights and prices for 1000 ft.

1. LESS COST

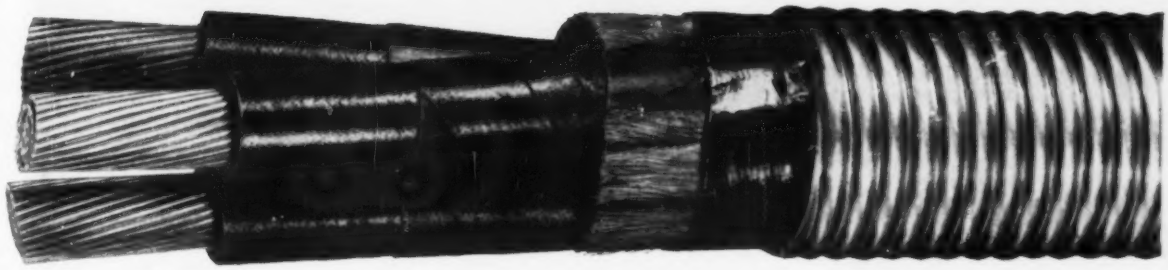
You realize important savings on *materials* with KW Aluminum Interlocked Armor Cable because (1) it gives you greater current-carrying capacity per dollar, (2) the nature of its aluminum armor eliminates costly conduit. Also, you save on *costly labor* because KW's corrosion resistant aluminum armor holds upkeep to a minimum, even in highly corrosive areas.

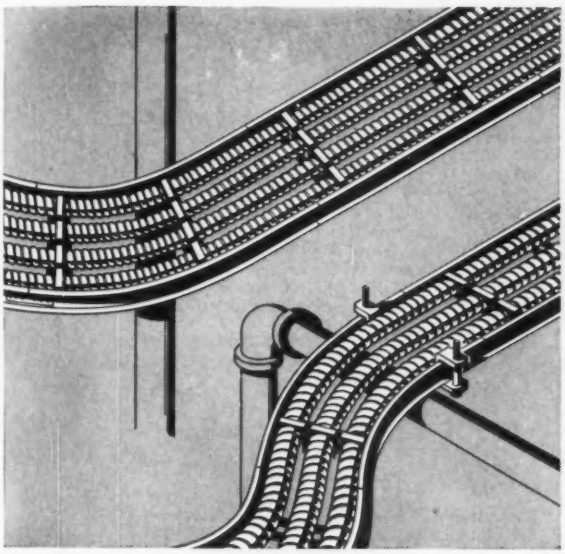
2. LESS WEIGHT

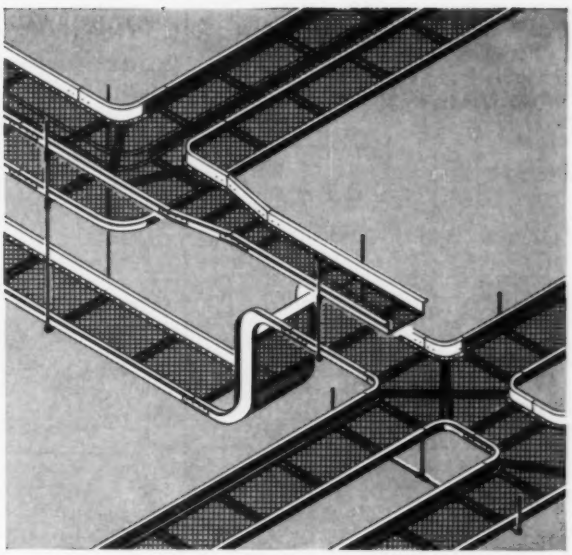
Any interlocked armor weighs far less than heavy, bulky steel conduit. But KW gives you *additional* weight savings because its armor is aluminum—weighing only ⅓ as much as steel or bronze. Moreover, because the conductors are also made of aluminum, they are less than half the weight of copper conductors that carry the same amount of current.

Versatile Use. KW Aluminum Interlocked Armor Cable is the ideal answer for industrial and commercial distribution systems, generator leads and auxiliary cable installations.

For complete information, call the Kaiser Aluminum sales office or KW distributor listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, Calif.







3. FASTER INSTALLATION

The light weight and supreme flexibility of KW Aluminum Interlocked Armor Cable mean easier handling, cut installation time in half. It can easily be bent horizontally or vertically around impeding objects and laid in longer lengths, eliminating the need for frequent splicing. In addition, because its diameter is less than conventional conduit systems, compact KW cable can bring space savings of up to 54%.

4. SPEEDIER MODIFICATIONS

KW Aluminum Interlocked Armor Cable may be laid on readily accessible racks, trays and troughs . . . or hung from a messenger. It is a quick and simple matter to expand KW Interlocked Armor Cable systems to meet increased power requirements which may arise after installation.

KAISER ALUMINUM

"If it Carries Current, KW Carries It!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network.
Consult your local TV listing.

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

Truck Equipment ..... Tensioners ☐
GE ..... Transformer ☐
Chance ..... Clamps ☐
Westinghouse ..... Covers ☐
Metalcraft ..... Fixture ☐
Orchard ..... Hot Stick ☐
Blackstone ..... Cleaner ☐
Exide ..... Batteries ☐
Pacific Mercury ..... Light ☐
Malleable Iron ..... Brackets ☐
Thermo Electric ..... Recorders ☐
Duff-Norton ..... Hoist ☐
PLM ..... Cable Spacer ☐
Dow Corning ..... Chemical ☐
Ideal ..... Hand Crane ☐

MANUFACTURERS LITERATURE

Code No. .....

(Requests are made from code numbers on page 148).

OTHER

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

✻ Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.

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DEPT. _____
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FOR:
Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

JULY 20, 1959

FLUIDICS

is a Pfaudler Permutit program providing
the know-how
the equipment
and the experience
for solving problems involving fluids

FLUIDICS AT WORK

Selecting water treatment systems to meet your specific needs

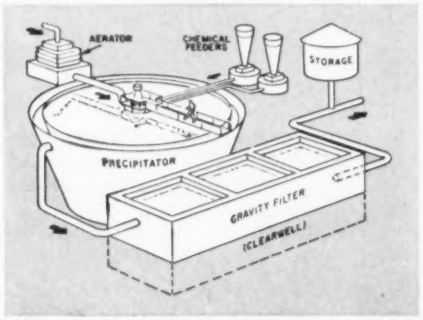
Many factors are involved in proper selection of water treatment equipment for specific use. Analysis of the raw water, volume and quality of water required, cost of equipment (both initial and operating), amortization rates and plans for future expansion, to cite just a few. The systems illustrated typify answers to widely varying requirements.

If you are concerned with any phase of water conditioning, bring an outline of your requirements to Permutit. As the largest and most experienced producer of water treatment equipment of every type, Permutit can assure you sound recommendations and the most efficient and economical system available for your particular need.

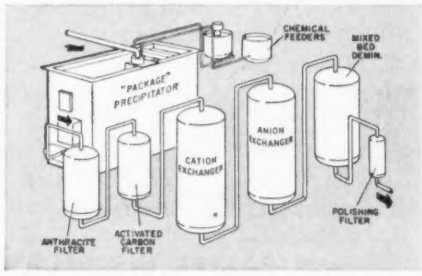
Write to the Permutit Division, Dept. EW-79, 50 West 44th Street, New York 36, New York . . . or Permutit Company of Canada Ltd., 207 Queen's Quay West, Toronto 1, Ontario; or 207 West Hastings Street, Vancouver 3, B. C.

FLUIDICS covers:

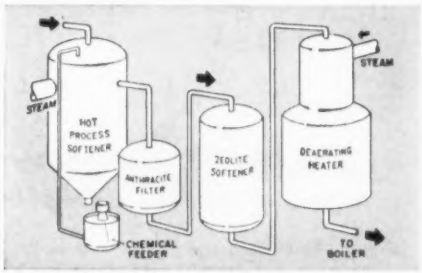
water treatment
waste treatment **blending**
corrosioneering **metering**
reactions **piping**
fluid analysis **storing**
agitation **heat transfer**
distillation **centrifuging**



Well water for municipal supply. Aerator reduces CO_2 to reduce acidity, reduces taste and odor and oxidizes dissolved iron and manganese. Precipitator removes turbidity, color, hardness and oxidized iron and manganese. Gravity filters remove remaining traces of turbidity.



Process water for electronic components. Package Precipitator removes bulk of turbidity, hardness and iron. Anthracite filter removes remaining suspended matter. Activated carbon filter takes out color and absorbs dissolved organics. Demineralizer—cation, anion, and mixed bed—reduces dissolved solids to guaranteed maximum. Polishing filter removes traces of suspended matter.



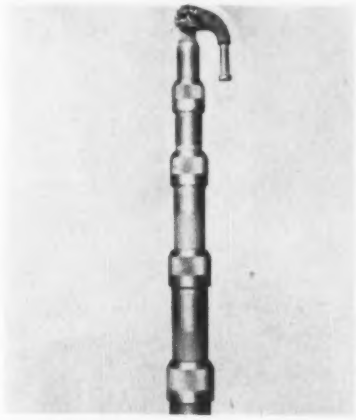
Water for steam boiler. Hot process softener reduces hardness to a few grains per gallon. Also reduces silica. Anthracite filter removes remaining turbidity. Zeolite softener may be added to system where zero hardness is needed. Finally, the deaerating heater removes oxygen to prevent corrosion.

PFAUDLER PERMUTIT INC.

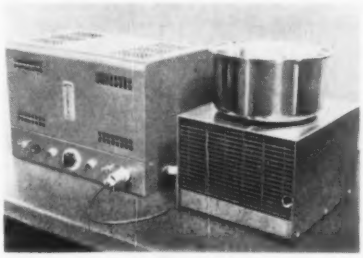
Specialists In FLUIDICS . . .
the science of fluid processes

Hot Stick . . .

(*Continued from page* 131)



lengths of 16, 20, 24 and 28 ft when extended, and each section locks individually in 4-ft increments. The arrangement takes only a twist of the wrist to lock each fiberglass section securely.
Actionflex Div, Orchard Industries, Inc, Hastings, Mich.



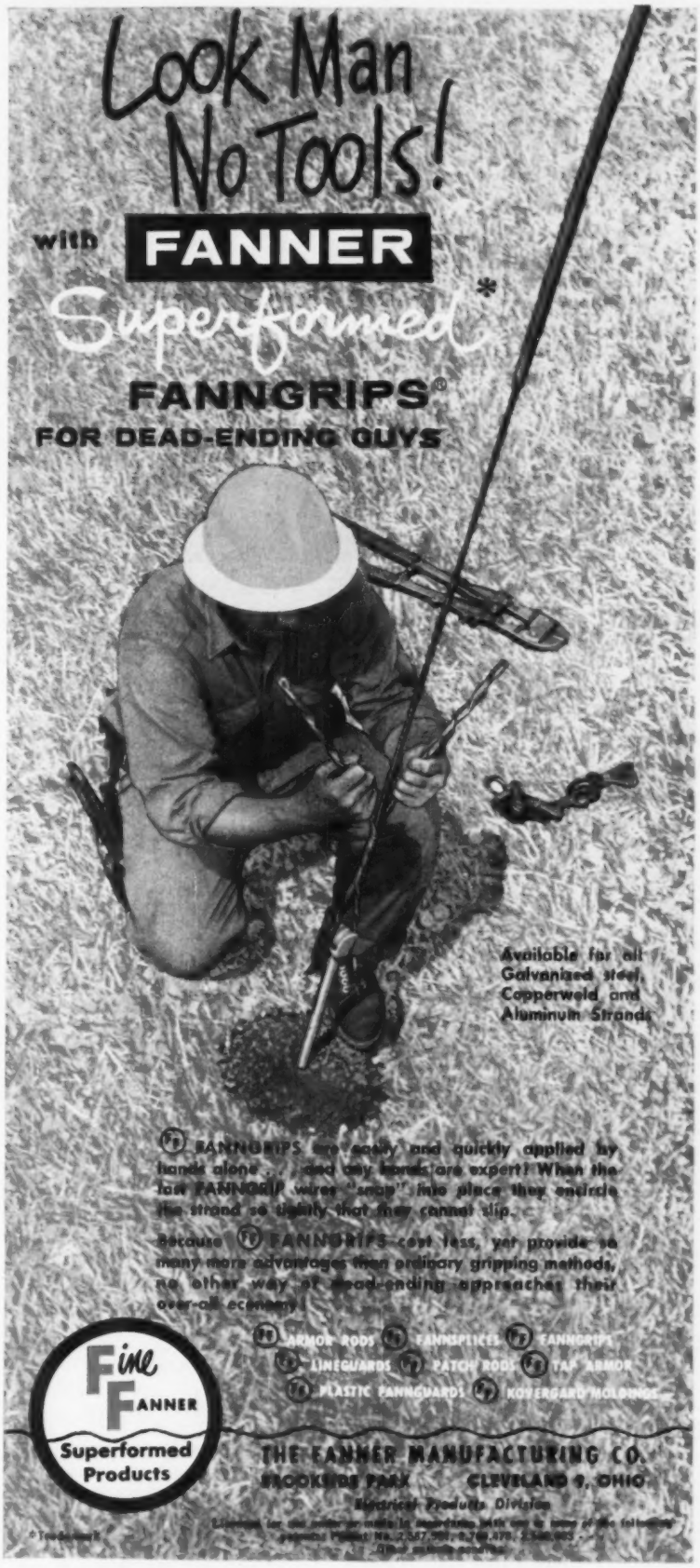
Ultrasonic Cleaner . . .

. . . has interchangeable tanks ranging in capacity from 2 qt to 6 gal. The Model GW-4A Ultrasonic System is available with interchangeable stainless steel lift-out tanks in either round or rectangular shapes.
Blackstone Corp, Jamestown, N. Y.

Batteries . . .

. . . in a new series extend the range of 8-hr capacities available in the plastic-jar line of moderate-cost stationary batteries upward by 1,020 amp-hr. Designated Type FWA, the series consists of four sizes with 8-hr capacities ranging from 840 to

(*Continued on page* 139)


Look Man No Tools!
with FANNER
Superformed*
FANNGRIPS®
FOR DEAD-ENDING GUYS
Available for all Galvanized steel, Copperweld and Aluminum Strands
FANNGRIPS are easily and quickly applied by hands alone . . . and any hands are expert! When the last FANNGRIP wires "snap" into place they encircle the strand so tightly that they cannot slip.
Because FANNGRIPS cost less, yet provide so many more advantages than ordinary gripping methods, no other way of dead-ending approaches their over-all economy!
ARMOR RODS PANNSPLICES FANNGRIPS
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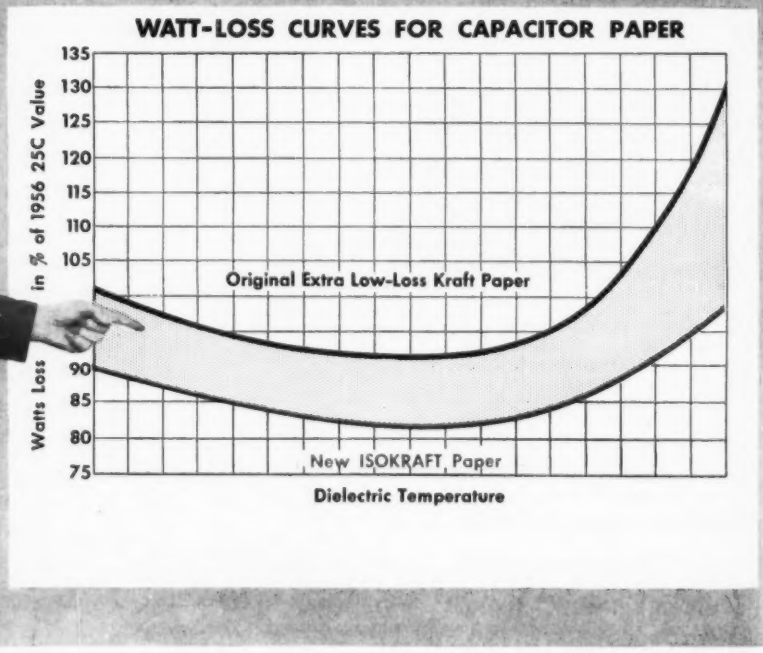
THE FANNER MANUFACTURING CO.
BROOKSIDE PARK CLEVELAND 9, OHIO
Electrical Products Division

GENERAL ELECTRIC ANNOUNCES...

NEW "ISOKRAFT 50"



NEW ISOKRAFT† PAPER WITH GREATER DIELECTRIC STRENGTH . . . multiplies G-E capacitor benefits through improved electrical characteristics. R. J. Hopkins, Manager of Power Capacitor Engineering, points to loss reduction, which is greatest at higher temperatures. Result: greater thermal stability, longer, more reliable capacitor life for "ISOKRAFT 50" capacitors. ISOKRAFT paper is covered by patent No. 2505545.

**14 percent lighter than previous General Electric units*

†*Trade-mark of the General Electric Co.*

W CAPACITORS

- **LONGER LIFE—**
  through 20% lower temperature rise
- **MORE RELIABLE—**
  because of greater thermal stability
- **EASIER TO INSTALL—**
  with 14% weight reduction

General Electric's new ISOKRAFT† paper dielectric, with other manufacturing and design improvements, now gives you smaller 50-kvar capacitors with greater reliability, longer life, easier installation.

LONGER LIFE—20% lower temperature rise permits cooler operation, lengthens capacitor operating life.

GREATER RELIABILITY—ISOKRAFT paper has a superior loss-versus-temperature characteristic (see chart left). The result is a more thermally stable unit.

EASIER TO INSTALL—14% reduction in weight and smaller size make installation faster, easier, permits more kilovars per pole: 600-kvar equipments replace 450-kvar equipments, with no weight increase.

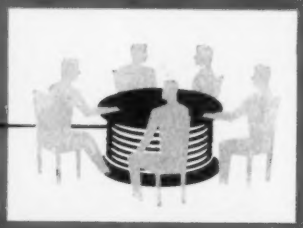
FOR COMPLETE INFORMATION on "ISOKRAFT 50" capacitors, write for bulletin GEA-6990—Section 445-27, General Electric Co., Schenectady, N. Y.

Progress Is Our Most Important Product

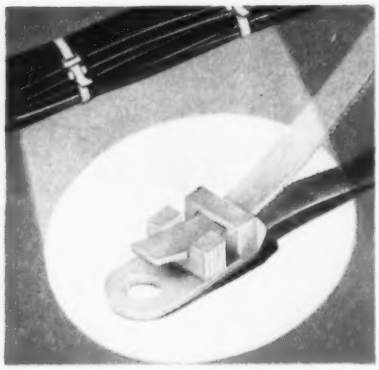
GENERAL ELECTRIC

WIRE AND CABLE ROUND TABLE

DU PONT



New clamps and ties of ZYTEL® have many advantages



These new "Lok-Strap" cable clamps and ties molded of Du Pont ZYTEL nylon resin offer advantages for either point-to-point wiring or pre-tied harness assemblies.

Adjustable in size, one "Lok-Strap" can replace a complete range of ordinary cable clamps. Because of the great strength of ZYTEL, these new clamps can withstand an unlocking force of 80 lbs., yet a few ounces of finger-tip pressure in the right place will release them. Also, there's no need to unscrew clamps for insertion or removal of wires. When harness must be disassembled, "Lok-Straps" are not cut off and destroyed. They can be opened and closed repeatedly, thus reducing revision and tracing costs considerably. And temperature is no problem: "Lok-Straps" have a service temperature range of -65°F. to 300°F.

"Lok-Straps" are molded of Du Pont ZYTEL by the Panduit Corporation, Midlothian, Ill.

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins for insulation and jacketing.

POLYCHEMICALS DEPARTMENT

Triplex jacketed with ALATHON® overcomes soda-ash contamination problem for LP&L

In many of its triplex installations in West Monroe, La., the Louisiana Power & Light Company is faced with the problem of soda-ash contamination from nearby industrial plants. This contamination is strong enough to damage ordinary conductor protective coverings.

In answer to this problem, the Southern Electrical Company of Chattanooga recommended its corrosion-resistant "Compresto"* cable, jacketed with Du Pont ALATHON polyethylene resin.

Besides overcoming the contamination problem, the tough jacket of ALATHON offers extra resistance to weather and abrasion from trees. In all, Mr. Hugh Balfour, Northern Division Engineer for LP&L summarized his company's opinion of "Compresto" by saying, "We have been very satisfied since switching to 'Compresto' cable jacketed with ALATHON. We recommend its use to other power suppliers faced with difficult environmental problems."

For information on how ALATHON can solve your problems, write your wire and cable manufacturer, or E. I. du Pont de Nemours & Co. (Inc.), Advertising Department, Room 177B, Nemours Building, Wilmington 98, Delaware.

*Registered TM of Southern Electrical Co.

DU PONT

Better Things for Better Living . . . *through Chemistry*

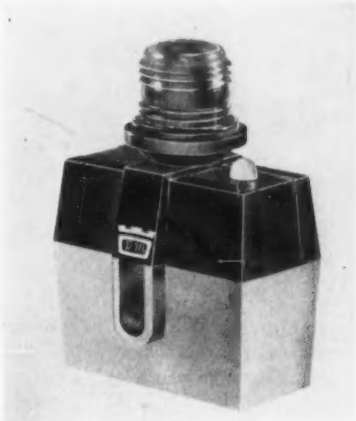
ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

Batteries . . .

(*Continued from page* 135)

1,680 amp-hr. They supplement the PWA and EWA series, which have capacities ranging from 50 to 660 amp-hr.

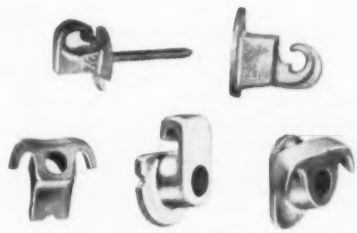
Exide Industrial Div, Electric Storage Battery Co, Rising Sun and Adams Aves, Philadelphia 20, Pa.



Warning Light . . .

. . . has full 360-deg visibility. It is available in transistor neon or transistor incandescent models with or without Solarstat, which automatically turns the light on when the sun goes down and turns it off at daybreak. Flash rate of the dome head light is adjustable.

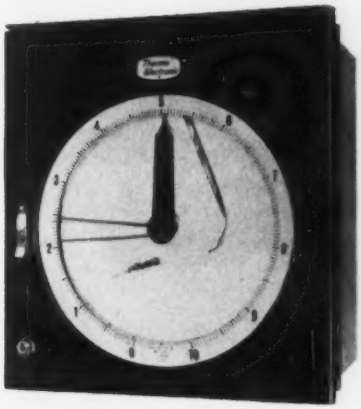
Pacific Mercury Co, 14052 Burbank Blvd, Van Nuys, Cal.



House Brackets . . .

. . . for attaching service drops to the house are available in a complete new line. Models are available for attachment to brick, concrete, metal or wood surfaces and will accept all types of dead-ending devices. On models that accept loops, all cable runs are smooth and of larger diameter to eliminate damage to the strand regardless of angle of pull off.

Malleable Iron Fittings Co, Branford, Conn.



Indicating Recorders . . .

. . . and indicating recorder controllers have accuracy to ±0.25% of scale or 5 microvolts. The units indicate, record and/or control any process variable convertible to voltage or resistance change. Applications include conductivity, flow, humidity, pressure, temperature measurement and many others.

Thermo Electric Co, Inc, Saddle Brook, N. J.

Spur Gear Hoist . . .

. . . combines portability with fast powerful action. The Coffing halfton Model CA-10 spur gear hoist weighs only 22 lb. The high-

(*Continued on page* 140)

Westinghouse TELEDUCTOR Magnetic Amplifier

more protection, savings, accuracy in measuring a-c voltages and current converts instrument transformer output to d-c milliamperes

In the telemetering of high-voltage feeder circuits or transmission lines, new Westinghouse teleductors offer many new advantages which have been previously unobtainable.

GREATER SAFETY . . . teleductor secondary may be open-circuited in current or voltage circuits without hazard to personnel and equipment

ECONOMICAL . . . costs less than conventional systems which use multiple meters or interposing relays

LONGER LIFE, LESS MAINTENANCE . . . completely static . . . no moving parts to wear or fail

EASILY INSTALLED . . . compact . . . can be mounted in any position

ACCURATE . . . linear output with both voltage and current input

GET ALL THE FACTS about the many ways new Westinghouse teleductors can put more savings and reliability in your telemetering operations. Contact your Westinghouse sales engineer. Or, write to Westinghouse Electric Corporation, Director Systems Department, 356 Collins Avenue, Pittsburgh 6, Pennsylvania. J-01013

YOU CAN BE SURE...IF IT'S Westinghouse

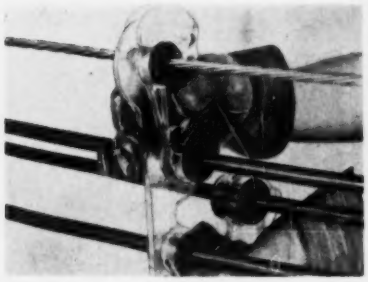
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Spur Gear Hoist . . .

(*Continued from page* 139)

strength aluminum alloy housing is designed to withstand impact and abuse. The hoist has an 8-ft standard lift.

Coffing Hoist Div, Duff-Norton Co, Danville, Ill.



Cable Spacer . . .

. . . for overhead distribution systems features unit construction that eliminates bolts, nuts, tools or any separate parts to install. Split neoprene grommets which compress around cables and messenger are preassembled in position in the spacer. It is installed by hanging spacer on messenger, then "wrapping" it around conductors and snapping it shut in the latched position. "WrapAround" spacers are made of Lucite and are supplied to fit cable from ⅜ to 1-in. diameter up to a 5-kv rating.

PLM Products, Inc, 3873 W 150th St, Cleveland 11, Ohio.

Amino-Silane Chemical . . .

. . . reacts with both organic and inorganic materials to unite them in a strong durable bond. Known as Dow Corning Z-6020, the silane can improve dielectric strength, heat stability and other properties of glass fiber materials.

Dow Corning Corp, Midland, Mich.

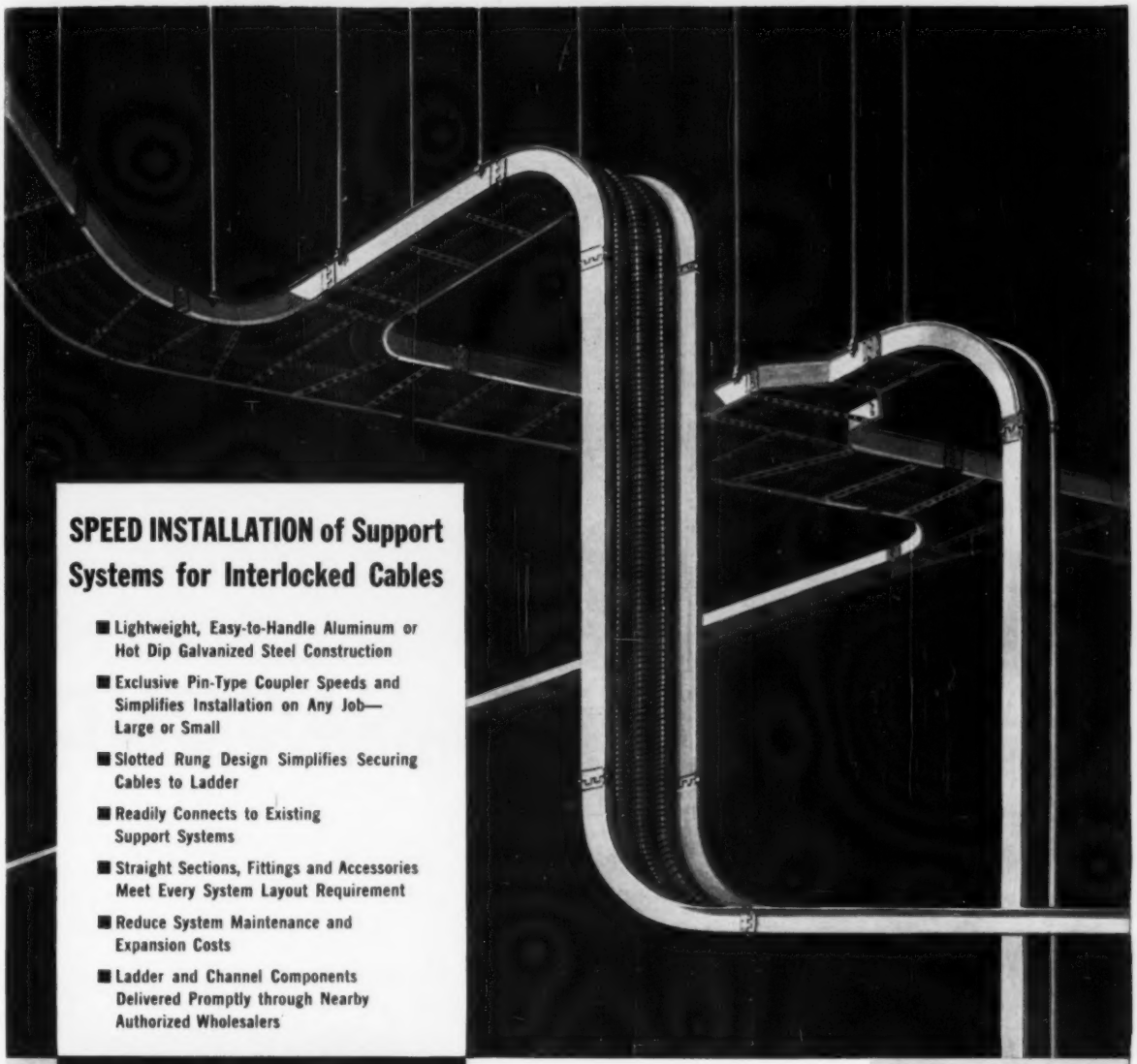
Hydraulic Hand Crane . . .

. . . is easily mounted on light utility trucks. Available in both 1,500 and

(*Continued on page* 144)

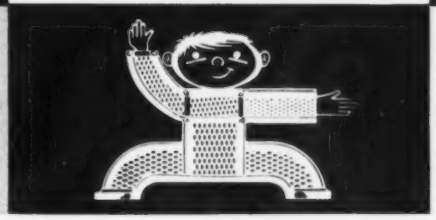
COPE LADDER and CHANNEL

FOR ARMORED CABLE DISTRIBUTION



SPEED INSTALLATION of Support Systems for Interlocked Cables

- Lightweight, Easy-to-Handle Aluminum or Hot Dip Galvanized Steel Construction
- Exclusive Pin-Type Coupler Speeds and Simplifies Installation on Any Job—Large or Small
- Slotted Rung Design Simplifies Securing Cables to Ladder
- Readily Connects to Existing Support Systems
- Straight Sections, Fittings and Accessories Meet Every System Layout Requirement
- Reduce System Maintenance and Expansion Costs
- Ladder and Channel Components Delivered Promptly through Nearby Authorized Wholesalers



ASK FOR PROOF! Speed your next job by getting details on Cope Ladder and Channel from your Authorized Cope Electrical Wholesaler today. For illustrated brochure describing system details, write direct to T. J. Cope, Division of Rome Cable Corporation, Collegeville, Pa.

COPE WIREWAY AND CHANNEL ARE SOLD ONLY THROUGH AUTHORIZED ELECTRICAL WHOLESALERS

1021

COPE

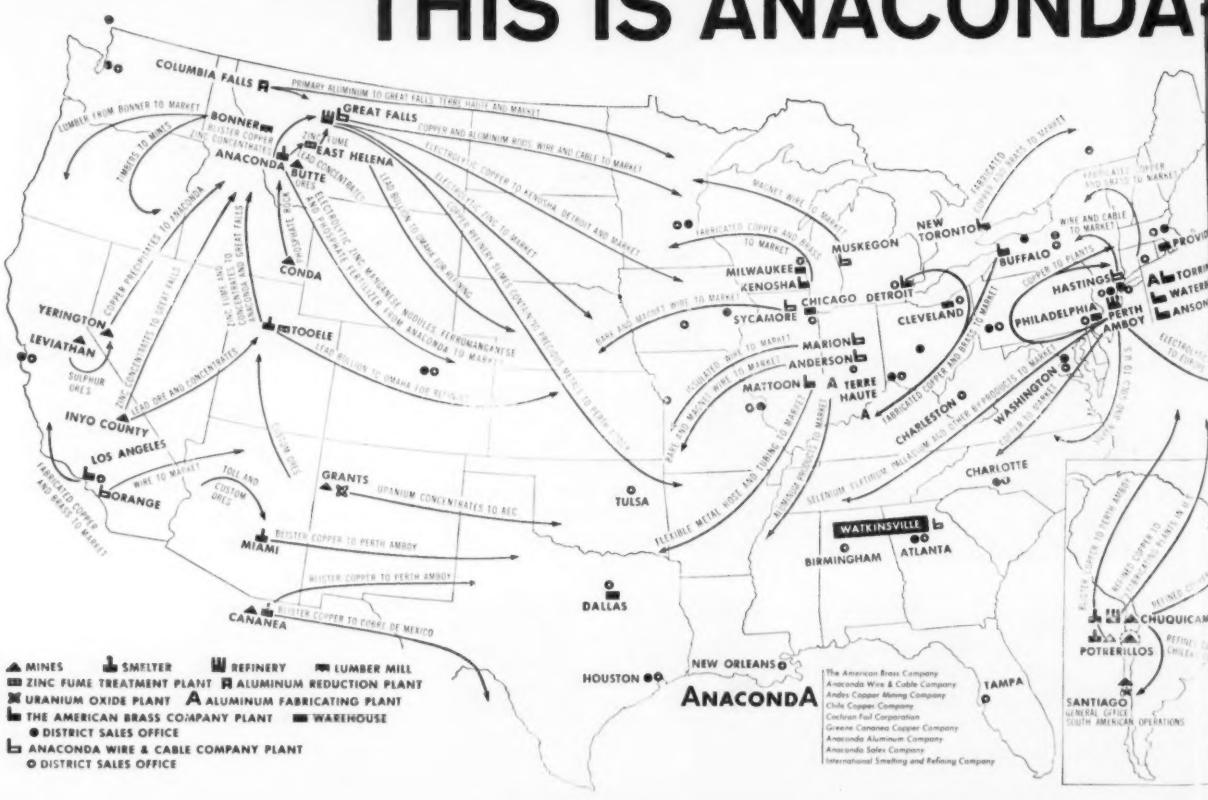
Originators of First Integrated Line of Cable Supporting Systems

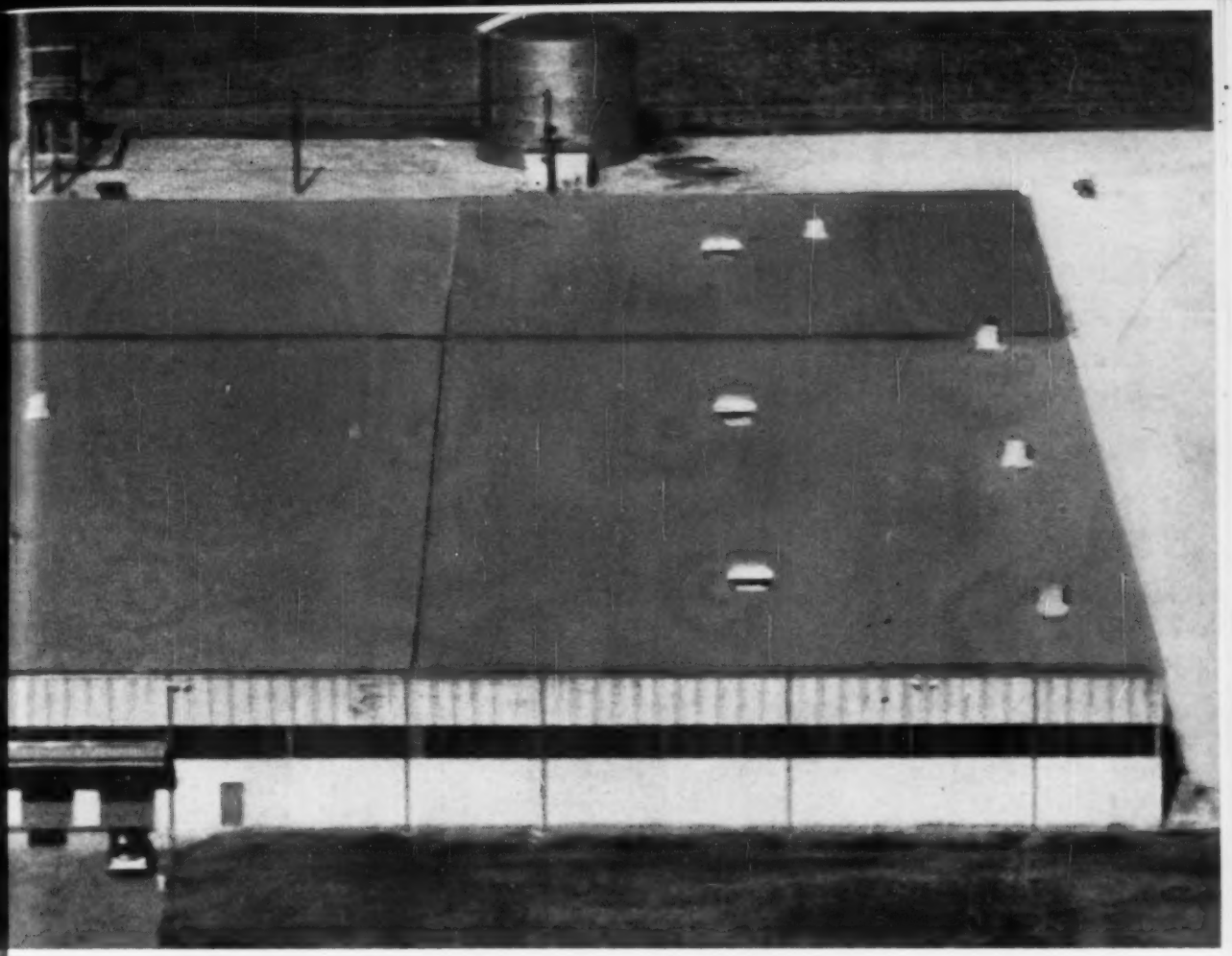
WIREWAY • LADDER • CHANNEL • CONTROLWAY

Division of ROME CABLE CORPORATION

COLLEGEVILLE, PENNSYLVANIA

THIS IS ANACONDA





A-AT WATKINSVILLE, GEORGIA:

Anaconda proudly announces the opening of a modern Wire & Cable Plant in the South... for the growing South!

There's an important addition to Anaconda's map of the United States—and you'll find it located in northeastern Georgia. It's Anaconda's new Watkinsville, Georgia, manufacturing plant, now officially "open for business."

This plant will provide the way to better-than-ever service to Anaconda customers throughout the South—thanks to its modern manufacturing and storage facilities, and central location.

In addition, the complete research and engineering facilities and the varied manufacturing skills of the entire Anaconda Wire & Cable Company are available to—and stand behind—the new Watkinsville plant, an expression of Anaconda's pride to be part of the growing, dynamic South. 59237

DISTRICT SALES OFFICES ARE LOCATED IN
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ANACONDA®
COPPER AND ALUMINUM WIRE & CABLE

From regulator to lamp

. . . use cost-saving

SUPERIOR CABLES

Thermoplastic Series Lighting Cables

- High resistance to earth acids and alkalis
- High resistance to sunlight, moisture, weather
- Small diameter, lightweight
- Easy to splice

Figure 8 Pole & Bracket Cable

- High resistance to abrasion, mechanical damage
- Does not deteriorate with age or weather
- Will not support combustion
- Flexible, strips clean, speeds installation

Performance and economy go hand in hand with SUPERIOR plastic insulated and jacketed cables.

All SUPERIOR CABLES are quality-engineered, precision manufactured and thoroughly tested.

From regulator to lamp . . . for low initial cost . . . for less maintenance cost . . . order SUPERIOR CABLES!

For complete information and prices, write

SUPERIOR CABLES

SUPERIOR CABLE CORPORATION

Hickory, North Carolina

3869

Hydraulic Hand Crane . . .

(*Continued from page* 140)

2,500-lb capacities, the crane can be interchanged between trucks equipped with an inexpensive mounting. It is also offered with a dolly mounting for warehouse use. **Ideal Crane Co, Inc, Box 516, Wichita Falls, Tex.**

More New Products

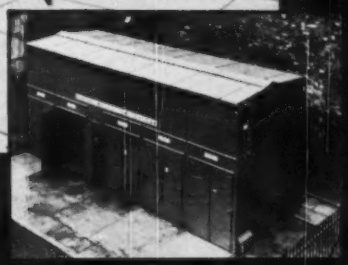
Selenium rectifier stacks can withstand surge currents 150% greater than previous models. Improved design permits full use of cell's voltage rating for up to 70,000 hr of continuous use.—General Electric Co, Semiconductor Products Dept, Syracuse, N. Y.

Submersible **wire** is available in No. 12, 10, 8 and 6, Plasticote-insulated, for installation in Artesian or other deep wells.—Chester Cable Corp, Chester, N. Y.

Nail hammer has Nylon-Vinyl deep cushion grip that withstands 20,000 v. The hammer has forged one-piece tool steel head and handle.—Estwing Mfg Co, Rockford, Ill.

Air dehydrator can furnish up to 3,000 cu ft per min of dry air up to 30 psig. It is known as Model KC-1114.—Kahn & Co, Inc, Box 516, Hartford 1, Conn.

Vinyl **wiring duct** is available in high-gloss mirror finish. It is offered in standard mirror finish gray or black, and in any bright color to special order.—Taylor Electric, Inc, 15400 Dale, Detroit 23, Mich.



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30%*
or more

WITH THE S.W.S. TYPE UE1

COMPLETE
34.5 Kv
metalclad
outdoor type

SWITCHGEAR UP TO 1500 MVA

Type UE1 is a factory engineered, assembled and wired "package unit" with ALL these advantages:

- Vertically isolated, withdrawable oil circuit breakers.
- Low initial cost — minimum erection time . . . factory assembled and wired.
- Minimum floor space required per cubicle — 6′ x 12′.
- Completely enclosed for all-weather servicing — Breaker contact inspection without breaker removal from cubicle.
- Complete enclosure of porcelain insulators and bushings provides protection from contamination.

Get the full details about this outstanding proven-in-service 34.5 Kv metalclad switchgear.

*As compared to conventional outdoor Switchgear.

SOUTH WALES SWITCHGEAR LIMITED

BLACKWOOD ENGLAND

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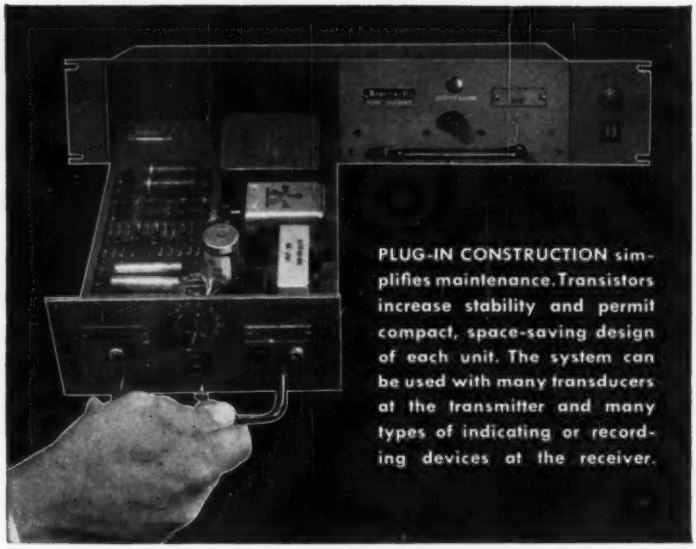
SWITCHGEAR—SWITCHFUSE GEAR—
TRANSFORMERS—CONTROL BOARDS

Millivolt-to-current transducer converts the mv signal of the sensing element to current.

Current-to-frequency transmitter converts current to a transmittable frequency that is a measure of the original variable.

Honeywell telemetering system

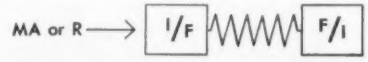


PLUG-IN CONSTRUCTION simplifies maintenance. Transistors increase stability and permit compact, space-saving design of each unit. The system can be used with many transducers at the transmitter and many types of indicating or recording devices at the receiver.

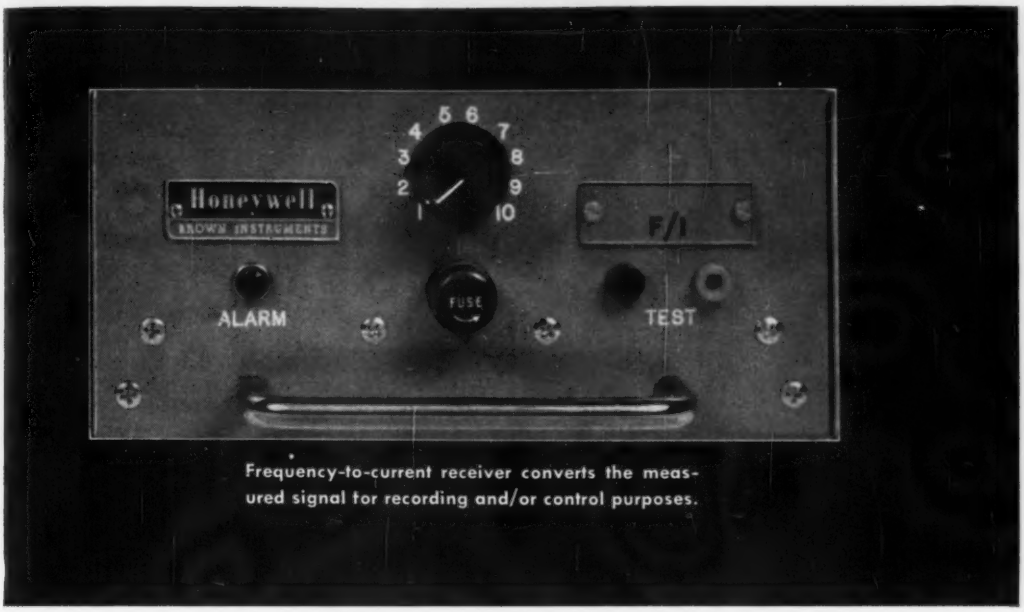
Use this system with a millivolt input—

Millivolt-to-current and current-to-frequency units transmit to a frequency-to-current receiver

Use this system with a milliamp or resistance input—



Current-to-frequency unit transmits to a frequency-to-current receiver.



Frequency-to-current receiver converts the measured signal for recording and/or control purposes.

is fully transistorized

...for greatest long-term reliability

Solid-state components scale down the size and build up the reliability of this Honeywell telemetering system. It consists of three basic units—transducer, transmitter, receiver—that can be used in different combinations to provide the particular type of frequency telemetering you require . . . frequently at a substantial saving. Modular construction makes possible this unusual flexibility.

With transistors instead of tubes, this fast-response, frequency-type system consumes little power, generates little heat. The compact units mount two-abreast in relay racks.

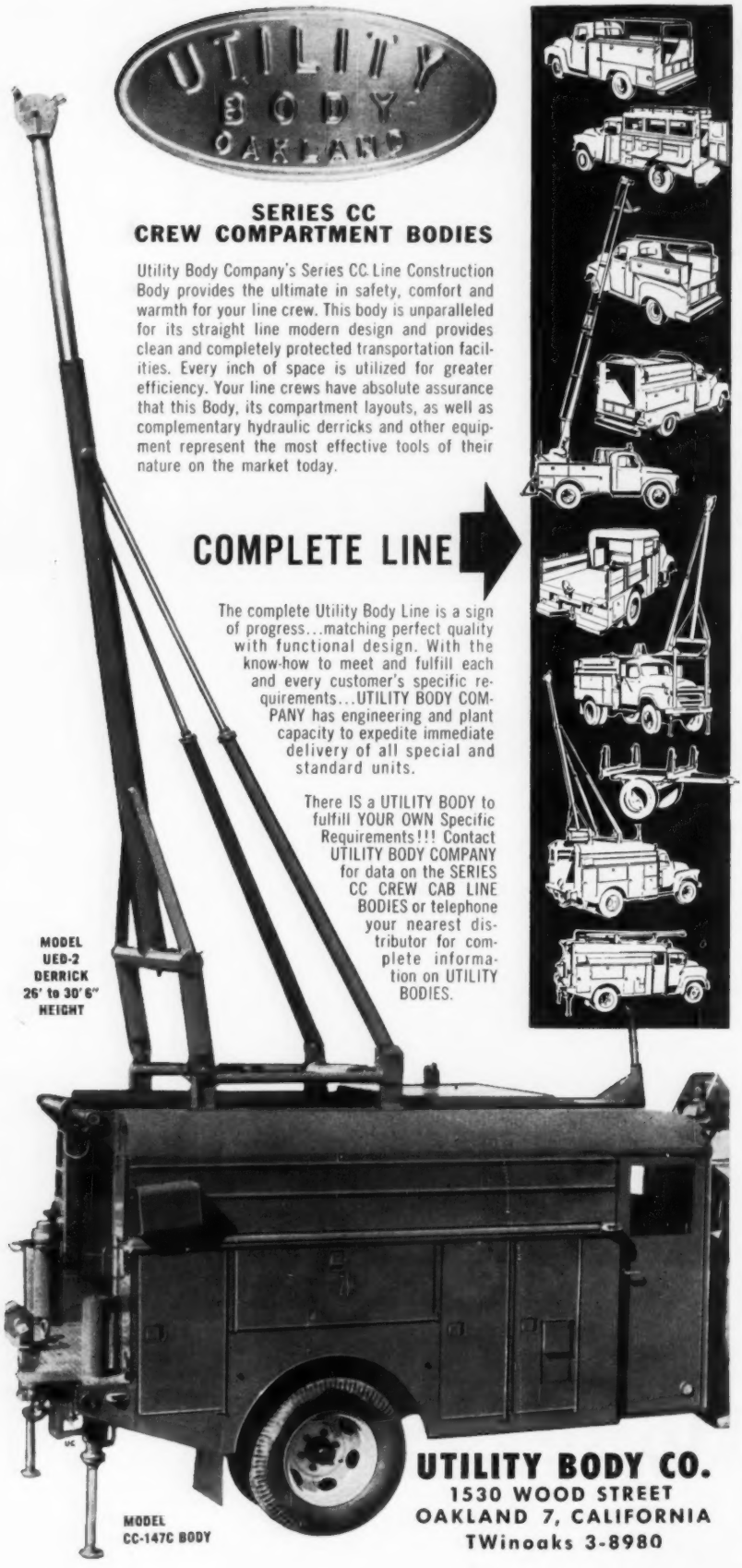
Use this highly accurate system for telemetering load, control intelligence, or any variable that can be transduced into an electrical signal. It's designed to meet all central station requirements, and is suitable for carrier, microwave, or direct wire line channels.

Your nearby Honeywell field engineer can give you complete details. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Control*



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CREW COMPARTMENT BODIES

Utility Body Company's Series CC Line Construction Body provides the ultimate in safety, comfort and warmth for your line crew. This body is unparalleled for its straight line modern design and provides clean and completely protected transportation facilities. Every inch of space is utilized for greater efficiency. Your line crews have absolute assurance that this Body, its compartment layouts, as well as complementary hydraulic derricks and other equipment represent the most effective tools of their nature on the market today.

COMPLETE LINE

The complete Utility Body Line is a sign of progress...matching perfect quality with functional design. With the know-how to meet and fulfill each and every customer's specific requirements...UTILITY BODY COMPANY has engineering and plant capacity to expedite immediate delivery of all special and standard units.

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MODEL UED-2 DERRICK 26' to 30' 6" HEIGHT

MODEL CC-147C BODY

UTILITY BODY CO.
1530 WOOD STREET
OAKLAND 7, CALIFORNIA
TWinoaks 3-8980

Manufacturers Literature

To request literature, use code numbers indicated for each item when filling in Reader Service form on page 134.

AUTOMATIC CIRCUIT RECLOSER . . . high-voltage, Type HVR, for 23- to 46-kv circuits, continuous-current ratings of 100, 140, 200, 280 and 400 amp, with recommended applications, specifications, design and operating feature illustrations provided. Bulletin 1560, 12 pages, I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa. F1

VOLTAGE DROP . . . in aluminum and copper conductors determined through use of 24 tables, simplified for reference in volts, giving values for the voltage drop found in aluminum and copper cables in direct current circuits. Voltage drop for alternating current circuits using magnetic conduit and non-magnetic conduit with power factors from 70% to 100%. Kaiser Aluminum & Chemical Sales, Inc, Dept NR-33, N Michigan Ave, Chicago 1, Ill. F2

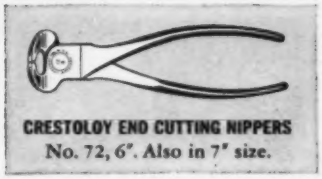
PIPE-TYPE CABLE INSTALLATIONS . . . high-pressure, 69 kv and above, describes cables and operating conditions in tabular form. Booklet S-110, 24 pages, Price $1.00. AIEE, 38 W 39 St, N. Y. 18. F3

CARBON STEEL TUBING . . . seamless or welded for pressure uses. Data on mechanical and physical properties, also on various fabrication operations performed on such tubing. Technical Data card 142B, 4 pages. Babcock & Wilcox Co, Beaver Falls, Pa. F4

SEALED RELAY CATALOG . . . contains information on hermetically sealed microminiature, sub-miniature, miniature, and high speed relays. Bulletin GEA-6628, 24 pages. General Electric Co, Schenectady 5, N. Y. F5

CURRENT LIMITING FUSES . . . hgih-voltage, Fusistor-type fuses for protecting potential transformers, small service transformers, control transformers, and auxiliary power transformers. Voltages from 120 v to 14.4 kv, with interrupting ratings to 130,000 amp, RMS asymmetrical. Bulletin 281. S&C Electric Co, 4435 Ravenswood Ave, Chicago, Ill. F6

WIRING SYSTEMS . . . standards for industrial use. Technical bulletin RCT-102, also available through salesman, Rome Cable, Rome, N. Y. F7



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No. 72, 6". Also in 7" size.

Each and every CRESTOLOY PLIER *is individually tested!*

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No. 542, 7" size only.

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CRESTOLOY LINEMENS' SIDE CUTTING PLIERS
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This Plier is made of CRESTOLOY STEEL and has tested 100% satisfactorily

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YOU, TOO, ARE A MAN

WHO HAS TO KNOW . . .

EXTRA PROFIT is the result of your investment in General Electric voltage regulators

Dividends from General Electric voltage regulators pay off in Extra Profit for you.

In addition to superior product design and workmanship, examine the benefits of Research, Service and Product Dependability that are available with your investment in General Electric regulators. No other manufacturer can match these dividends.

REGULATOR RESEARCH from General Electric has provided industry leadership in regulator development, and will continue to provide even more efficient and economical system regulation in the future.

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The effects of a regulator purchasing decision will be felt for many years by operating personnel, responsible for equipment maintenance, and by utility management, responsible for profit. The next time you review your regulator requirements, consider the important dividends which *only* G.E. offers . . . and specify General Electric voltage regulators. General Electric Co., Schenectady 5, New York. 423-38

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GENERAL ELECTRIC

J. Coleman Jones, General Superintendent, tells why . . .

DEPENDABILITY paid a dividend for Pacific Power & Light's investment in General Electric voltage regulators. Dependable performance of G-E MLT-32 three-phase step voltage regulators holds maintenance time and cost down, provides reliable substation regulation.

W. E. Dugdale, Purchasing Agent, tells why . . .

SERVICE paid a dividend for Upper Peninsula Power's investment in General Electric voltage regulators. Overnight regulator delivery cut outage time to an absolute minimum.

George K. Kallenbach, Operating Superintendent, tells why

RESEARCH paid a dividend for Niagara Mohawk's investment in General Electric voltage regulators. G-E system research used network analyzers to determine the optimum regulator arrangement to solve a unique problem.

PACIFIC POWER & LIGHT COMPANY

DRILLED OUT OF ROCK, the underground powerhouse is 486 ft long, 75 ft wide and 132 ft high. It will house five turbo-generators each with 100-Mw capacity. These will supply 13 435-ton transformers producing 330 kv for grid

TWO LOWER SECTIONS of north bank coffer dam were blasted in summer of '57, after March flood damage repairs

CENTER COFFER DAM was flooded in '58 with a flow of water double the previous record. Damage: $7.9 million

Kariba: Big Test of Men and Machines

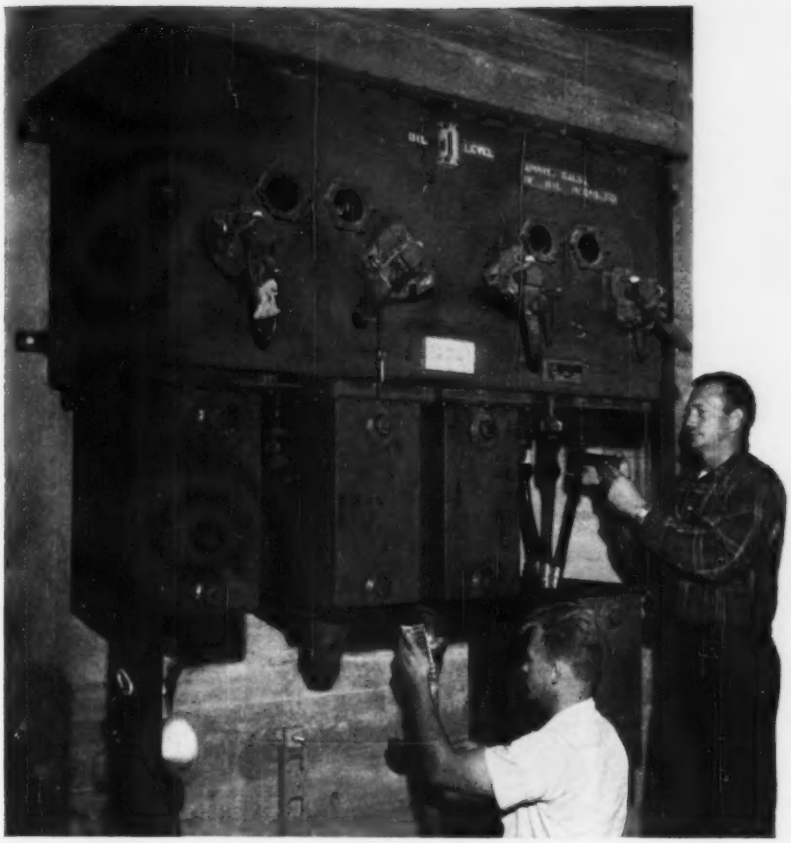
(*Continued from page* 85)

ing conditions arduous. A refrigeration plant with 10.5-million Btu/hr cooling capacity lowered temperature of freshly laid concrete through pipes embedded in the wall. Another difficulty was the magnitude of underground work. A total of 850,000 cu yd of rock was mined for the 468 x 75 x 132 ft power house and the 537 x 55 x 60 ft transformer house. In addition, three tailrace tunnels were constructed, each 950 ft long with 34 ft dia.

Both power and transformer houses are 600 ft underground. The powerhouse turbines will supply power to the 60,000-kva, 330/33-kv, 3-phase transformers. The 13 transformers, in turn, will supply 330 kv to the power grid.

Construction of 5,400 mi of transmission line will bring the clearing of 30,000 acres of virgin forest land. A total of 930 mi of 330-kv single-circuit steel tower lines will connect Kariba with Kitwe on the Northern Rhodesian Copperbelt, to Salisbury and to Bulawayo.

The federal government of Rhodesia and Nyasaland has not stated how much Kariba power will cost. It depends on the cost of thermal power that will firm up the project's output, the government says. The busbar estimates for Kariba power range from .869 pence per kwhr in 1961 down to .283 per kwhr in 1972. Average cost today for thermal power at, for example, Salisbury and Bulawayo, is about .728 pence per kwhr. For conversion purposes, 6 pence equals 7¢.



Stud bushing compartments on G&W load break oil switches permit adding new circuits without interruption to existing loads.

Small city + big plans = TWO-FOLD ECONOMY

for underground distribution system

Sound distribution system planning by engineers of the Modesto Irrigation District in California has paid off handsomely. The system they used was economical to install and economical to expand.

In 1942, when few small cities had 12 kv underground electrical distribution systems, MID engineers began drafting one for Modesto. Work on the new system was started by running feeders from existing 12 kv overhead lines. G&W load break oil switches and oil link boxes simplified installation and provided spare ways for adding new circuits quickly and easily as the city grew. As a result, service interruptions and expense have been kept to a minimum.

Today, after experiencing years of excellent service, MID continues to specify G&W equipment—products backed by long experience, thorough engineering skill and complete manufacturing resources. Consult *your* nearest G&W representative for complete satisfaction on your distribution system problems.

Write for new bulletin giving the full story of the Modesto installation —a down-to-earth job report on how G&W equipment saved time and money.

G&W ELECTRIC SPECIALTY CO.

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BIG NEWS!

ROECLAMPS®

with associated cables

NOW FOR 15 KV

1. TURN THE NUT... and open. A few seconds—and the Roeclamp is on the messenger.

MINIMIZE TREE PROBLEMS, REDUCE OUTAGES, SAVE 75% OVER SELF-SUPPORTING CABLES

When Roeclamps with Associated Cables were introduced recently for 5 kv and 8 kv systems, the response was immediate and tremendous. Now the same advantages of greatly reduced cost, much easier installation, compactness, added attractiveness, greater current-carrying capacity, easy servicing, and virtual elimination of outages caused by falling limbs, are available for 15 kv systems with new 15 kv Roeclamps with Associated Cables.

The pictures show you how easy installation of each Roeclamp is, even with "boxing gloves" on. It takes under a minute, without tools. Phase identification is positive at a glance, since all cables are in the same relative position all along the line. What's more, you can add phases, or remove them, and the system can be reinforced, without *removing Roeclamps from the messenger!*

And what can you expect when Roeclamps with Associated Cables are in operation? Better voltage regulation, for one thing, because of low reactance. Higher current-carrying capacity, too. And the strong messenger practically eliminates outages caused by falling limbs or lightning. Conductors are available in copper or aluminum. Roebling's engineers will be happy to select the best insulation for your application.

In a nutshell, if you have a 15 kv system, or are contemplating one, get the vital facts about new 15 kv Roeclamps with Associated Cables now. Your Roebling representative will gladly demonstrate the Roeclamp. Just give him a call—or write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, N. J.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

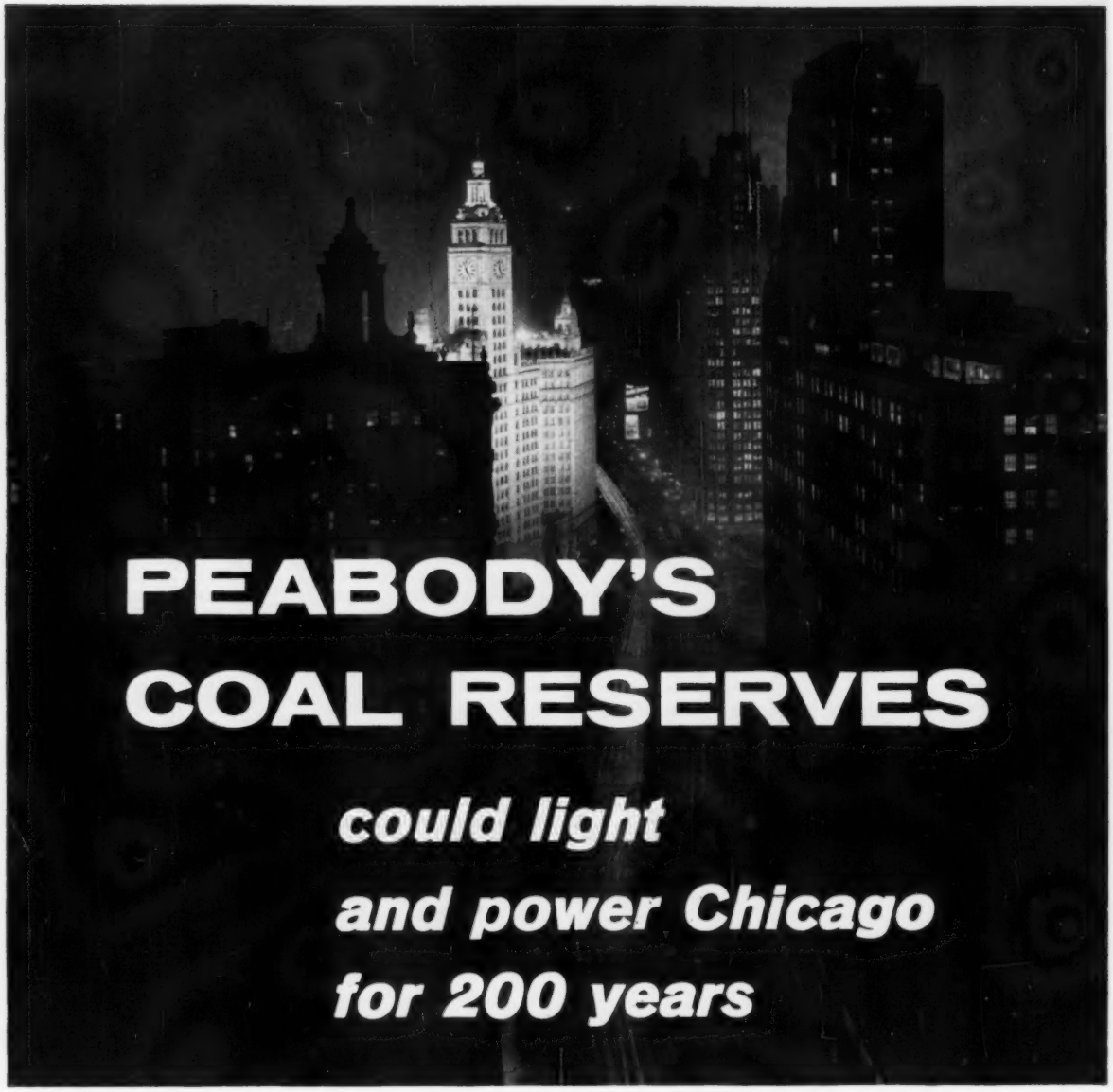
2. PUSH UP . . . the Roeclamp is ready for conductors! They drop easily into place.

3. CLOSE . . . and hand-tighten. Roeclamp is completely installed—without removing gloves, and without tools!

About New 15 KV Roeclamps

They're strong—test to 1800 lb breaking strength! Tough Plexiglas* defies weathering, has top electrical properties. Conductors are at 7-inch centers for best electrical protection, easy installation. Roeclamps have unit construction, no separate parts. The big nut can be loosened readily, even with "boxing gloves" on. It hand-tightens. No tools required ever . . . no clamp is easier to install. And you never have to remove the Roeclamps for phase changes or repairs. Roeclamps come complete with grommets to fit the messenger and cables you order. Only 34 Roeclamps are required every 1000 feet.

*Reg. T. M.—Rohm & Haas Company



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could light and power Chicago for 200 years

It takes a lot of electrical energy to light and power a modern city, and it takes millions of tons of coal to generate that electricity. That's why many of the nation's major electric utilities and large industries depend on PEABODY Coal. Long-term contracts assure them a dependable fuel source, backed by PEABODY'S two billion tons of proven reserves. And PEABODY'S ultramodern mining, processing and shipping equipment is geared to provide this coal "tailor-made" for their particular needs . . . efficiently and economically. If this is the fuel service YOU need, check with PEABODY first!

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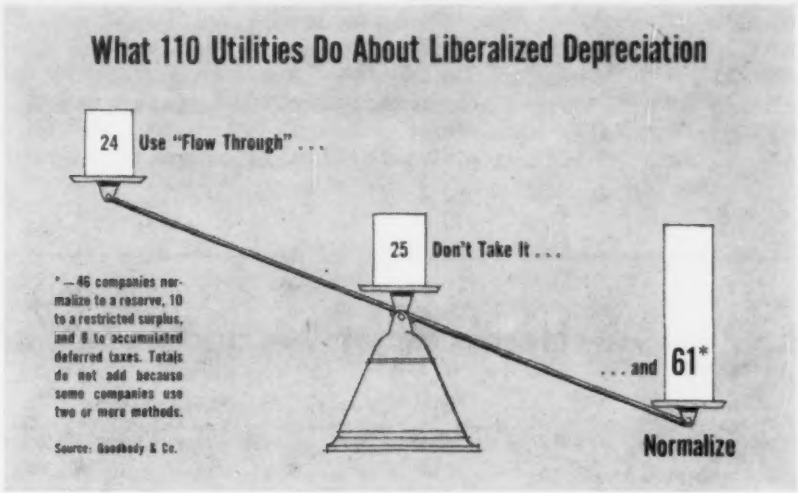
What 110 Utilities Do About Liberalized Depreciation
24 Use "Flow Through" . . .
25 Don't Take It . . .
. . . and 61*
Normalize
* — 46 companies normalize to a reserve, 10 to a restricted surplus, and 8 to accumulated deferred taxes. Totals do not add because some companies use two or more methods.
Source: Goodbody & Co.

Analysts are still weighing fast depreciation. Here's . . .

A Wall St. View of L.D. and A.A.

Finance

How does Wall Street compare your company's stock with other utilities' commons? According to one brokerage firm, the days of across-the-board comparisons are over, and it's no longer valid to compare the stocks of utilities that use different methods of accounting for the benefits of liberalized depreciation and accelerated amortization. Goodbody & Co has published a research study of 110 electric utilities, breaking them into comparable groups and providing data needed for measuring them against one another. T. W. Locke, Goodbody's utility specialist and the author of the study, suggests that investors confine themselves to comparing utilities that handle these benefits in the same way.

Merely adjusting the earnings of companies to the same basis won't do, he points out. For example, a company that does not take liberalized depreciation might be compared with a company that takes it and flows the tax benefits through directly to earnings by simply subtracting the "flow-through" company's saving. "This may give a good statistical result," says Locke, "but not a very useful one, since the market price has not been changed by the adjustment, and the market evaluation is of great importance in comparisons."

An interesting by-product of the study is the classification of electric utility companies into groups according to their method of handling liberalized depreciation and accelerated amortization. Most companies normalize the benefits of both. Of the 110 companies studied, 61 use a form of normalization for liberalized depreciation benefits, 24 use the "flow-through" method, and 25 do not take it at all. Of the companies that use normalization, 46 credit a reserve account, ten credit a restricted surplus, and eight credit accumulated deferred taxes. (Two companies use different methods in different states.)

Also, 40 companies are now normalizing accelerated amortization certificates to a reserve, 31 are normalizing them to a special surplus account, and 13 are normalizing them to accumulated deferred taxes. Twenty-four companies are

not using accelerated amortization. Since the certificates run for five years after completion of the facilities for which they are issued, and since no more have been issued to power companies recently accelerated amortization will probably cease to influence utility earnings within a few years.

The table below shows how 99 utilities handle the benefits of liberalized depreciation and accelerated amortization, with Goodbody's estimates of the amount of each credit for 1959 and 1960. Data on the other companies could not be made public because of prospectus requirements. While the firm's report did

Here's What 99 Electric Utilities Are Doing About

Company	Uses L.D.?	How?	Earned per Share 1958	Tax Benefits from L.D. per Share 1958	1959 est.	1960 est.	Uses A.A.?	How?	Tax Benefits from A.A. per Share 1958	1959 est.	1960 est.
American Electric Power	Yes	R*	$2.30	$0.17	$0.23	$0.29	Yes	RS	$0.73	$0.70	$0.81
Arizona Public Service	Yes	Flo	1.88	0.32	0.39	0.54	Yes	RS	0.25	0.19	None
Arkansas-Missouri Power	No	—	1.38	—	—	—	No	—	—	—	—
Atlantic City Electric	Yes	RS	1.92	0.25	N.A.	N.A.	Yes	RS	0.25	N.A.	N.A.
Baltimore Gas & Electric	No	—	2.39	—	—	—	No	—	—	—	—
Boston Edison	Yes	R	3.55	0.43	0.63	0.71	Yes	R	0.24	0.16	0.02
California Electric Power	Yes	Flo	1.14	0.19	0.23	0.29	Yes	ADT	0.23	0.16	0.15
California-Oregon Power	Yes	Flo	1.98	0.19	0.23	0.26	Yes	R	1.27	1.14	1.14
Carolina Power & Light	No	—	2.00	—	—	—	Yes	RS	0.44	0.47	0.29
Central Hudson Gas & Electric	Yes	Flo	1.17	0.14	0.22	0.30	Yes	ADT	0.29	0.09	−0.03
Central Illinois Electric & Gas	Yes	R	2.08	N.A.	0.16	0.20	Yes	R	0.32	N.A.	N.A.
Central Illinois Light	Yes	R	1.99	0.24	0.33	0.35	Yes	R	−0.01	−0.03	−0.05
Central Illinois Public Service	Yes	R	2.57	0.21	0.22	0.33	Yes	R	−0.01	−0.01	−0.01
Central Louisiana Electric	Yes	R	2.21	0.33	0.38	0.41	Yes	R	0.46	0.50	0.48
Central Maine Power	Yes	Flo	1.65	0.20	0.22	0.22	Yes	ADT	0.51	0.51	0.32
Central & South West	Yes	ADT	2.54	0.26	0.33	0.42	Yes	ADT	0.51	0.44	0.35
Central Vermont P S	Yes	Flo	1.33	0.10	N.A.	N.A.	Yes	RS	0.01	N.A.	N.A.
Cincinnati Gas & Electric	Yes	ADT	1.85	0.12	0.15	0.20	Yes	ADT	0.27	0.26	0.10
Colorado Central Power	Yes	RS	2.00	N.A.	N.A.	N.A.	Yes	RS	0.45†	N.A.	N.A.
Cleveland Electric Illuminating	Yes	R	2.60	0.21	0.30	0.32	Yes	RS	0.56	0.34	0.56
Columbus & Southern Ohio	Yes	R	2.02	0.34	0.49	0.49	Yes	R	0.52	0.52	0.52
Commonwealth Edison	Yes	R	3.28	0.41	0.53	0.58	Yes	R	0.08	0.15	0.15
Community Public Service	Yes	ADT	1.32	0.13	0.15	0.17	No	—	—	—	—
Connecticut Light & Power	Yes	Flo	1.41	0.17	0.17	0.23	Yes	R	0.16	0.07	0.01
Consumers Power	Yes	R	3.15	0.37	0.50	0.63	Yes	R	0.34	0.27	0.21
Dayton Power & Light	No	—	3.21	—	—	—	No	—	—	—	—
Delaware Power & Light	Yes	ADT	2.89	0.43	0.57	0.74	Yes	ADT	0.88	0.89	0.58
Detroit Edison	Yes	R	2.17	0.30	0.38	0.43	Yes	R	0.30	0.05	−0.06
Duke Power	No	—	2.08	—	—	—	No	—	—	—	—
Duquesne Light	Yes	Flo	1.40	0.11	0.13	0.14	Yes	RS	0.13	N.A.	N.A.
El Paso Electric	Yes	R	1.57	0.16	0.21	0.25	Yes	R	0.27	0.26	0.12
Empire District Electric	Yes	R	1.61	0.17	0.18	0.20	Yes	R	0.27	0.11	0.04
General Public Utilities (d)	Yes	Flo	2.85 av	0.29	0.40	0.48	Yes	RS	0.19	N.A.	N.A.
Hartford Electric Light	Yes	Flo	4.08	0.45	0.57	0.66	Yes	R***	0.52	0.75	0.53
Houston Lighting & Power	No	—	2.94	—	—	—	Yes	ADT	0.39	N.A.	N.A.
Illinois Power	Yes	R	2.10	0.19	0.25	0.30	Yes	R	0.19	0.09	0.04
Indianapolis Power & Light	Yes	R	2.20	0.22	0.26	0.28	Yes	R	0.35	0.17	0.17
Interstate Power	No	—	1.09	—	—	—	No	—	—	—	—
Iowa Electric Light & Power	Yes	R	2.07	0.24	0.29	0.33	Yes	R	0.31	0.31	0.22
Iowa-Illinois Gas & Electric	Yes	R	2.35	0.18	0.21	0.25	Yes	R	0.06	0.06	0.06
Iowa Power & Light	Yes	R	2.03	0.22	0.32	0.36	Yes	R	0.50	0.26	0.11
Iowa Public Service	Yes	R	1.13	0.11	0.15	N.A.	Yes	R	0.11	0.06	N.A.
Iowa Southern Utilities	Yes	R	1.95	0.22	0.26	0.30	Yes	R	0.40	0.02	0.02
Kansas City Power & Light	Yes	R	3.05	0.28	0.34	0.42	Yes	R	0.35	0.50	0.50
Kansas Gas & Electric	No	—	2.52	—	—	—	No	—	—	—	—
Kansas Power & Light	Yes	R	2.10	0.25	0.24	0.28	Yes	R	0.09	0.08	−0.03
Kentucky Utilities	Yes	R	2.36	N.A.	N.A.	N.A.	Yes	R	0.43†	0.32†	N.A.
Lake Superior District Power	Yes	R	1.57	0.14	0.15	0.19	No	—	—	—	—
Louisville Gas & Electric	No	—	2.22	—	—	—	No	—	—	—	—
Madison Gas & Electric	Yes	D	3.43	0.58	0.59	N.A.	No	—	—	—	—

* — Normalized in Ohio only. In 1958, 14¢ per share was normalized and 3¢ per share was "flowed through." Estimate of distribution for 1959 is 19¢ normalized and 4¢ "flowed through." Estimate for 1960 is 24¢ normalized and 5¢ "flowed through."

** — Normalized in Illinois only. In 1958, 1¢ per share was normalized and 13¢ per share was "flowed through." Estimate of distribution for 1959 is 2¢ normalized and 19¢ "flowed through." Estimate for 1960 is 2¢ normalized and 21¢ "flowed through."

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not recommend any stocks for purchase based on the study, it did express the hope "that more and more investors will gradually come to understand the important and increasing effect that the use of liberalized depreciation can have on reported earnings, capitalization ratios, necessary equity financing, and cash generated within a company. It can also have a bearing on rate increases," the report concluded, "especially where a commission substitutes liberalized depreciation benefits in place of needed and justifiable rate relief." Copies of the entire 14-page study, of which this is a summary, are available on request from T. W. Locke, Goodbody & Co, 115 Broadway, New York 6, N. Y.

Liberalized Depreciation and Accelerated Amortization

Company	Uses L.D.?	How?	Earned per Share 1958	Tax Benefits from L.D. per Share 1958	1959 est.	1960 est.	Uses A.A.?	How?	Tax Benefits from A.A. per Share 1958	1959 est.	1960 est.
Maine Public Service	Yes	R	$1.55	$0.12	$0.13	N.A.	Yes	R	$0.16	$0.15	N.A.
Middle South Utilities	Yes	ADT	2.61	0.33	0.43	$0.46	Yes	ADT	0.51	0.21	$0.06
Minnesota Power & Light	No	—	2.32	—	—	—	Yes	ADT	0.43	0.42	N.A.
Missouri Public Service	Yes	R	0.91	0.05	None	None	Yes	R	0.12	0.12	0.04
Montana-Dakota Utilities	Yes	ADT	1.65	0.13	0.16	0.16	Yes	ADT	0.13	0.12	N.A.
Montana Power	Yes	Flo	3.97	0.13	0.17	0.21	Yes	RS	0.10	0.24	0.24
New England Electric System	No	—	1.26	—	—	—	Yes	R	0.15	0.17	0.17
New England G & E	Yes	R	1.60	0.17	0.22	0.26	No	—	—	—	—
New York State E & G	Yes	Flo	3.90	0.42	0.53	0.60	Yes	RS	0.48	0.25	0.19
Niagara Mohawk Power	Yes	Flo	2.12	0.28	0.38	0.47	Yes	RS	0.25	0.09	0.04
Northern Indiana Public Service	Yes	R	2.77	0.29	0.36	N.A.	No	—	—	—	—
Northern States Pwr	No	—	1.30	—	—	—	Yes	ADT	0.07	0.04	0.02
Northwestern Public Service	Yes	R	1.37	0.18	0.19	0.21	No	—	—	—	—
Ohio Edison	Yes	ADT	3.60	N.A.	N.A.	N.A.	Yes	ADT	1.04†	N.A.	N.A.
Oklahoma Gas & Electric	No	—	1.45	—	—	—	Yes	R	0.33	0.37	0.29
Orange & Rockland Utilities	Yes	Flo	1.29	0.21	N.A.	N.A.	Yes	RS	0.44	N.A.	N.A.
Otter Tail Power	No	—	2.34	—	—	—	No	—	—	—	—
Pacific Gas & Electric	Yes	D	3.74	N.A.	N.A.	N.A.	Yes	RS	0.55	0.71	0.48
Pacific Power & Light	Yes	Flo	2.40	0.22	0.40	N.A.	Yes	RS	0.46	0.93	N.A.
Pennsylvania Power & Light	No	—	3.22	None	N.A.	N.A.	Yes	RS	0.71	None	None
Portland General Electric	Yes	Flo	1.80	0.24	0.34	0.36	Yes	RS	0.41	0.70	0.67
Public Service of Colorado	Yes	RS	2.66	0.31	0.36	0.45	Yes	RS	0.59	0.46	0.35
Public Service of Indiana	Yes	R	2.91	0.28	0.38	0.48	Yes	R	0.41	0.50	0.40
Public Service of N. H.	Yes	Flo	1.26	0.12	0.15	0.18	Yes	R	0.19	0.12	N.A.
Public Service of New Mex	No	—	1.39	—	—	—	Yes	RS	0.23	0.34	0.18
Puget Sound Power & Light	Yes	Flo	1.97	0.18	0.27	0.34	No	—	—	—	—
Rochester Gas & Electric	Yes	Flo	2.58	0.35	0.39	0.48	No	—	—	—	—
San Diego Gas & Electric	No	—	1.32	—	—	—	No	—	—	—	—
Sierra Pacific Power	Yes	ADT	1.94	0.22	0.26	0.30	No	—	—	—	—
South Carolina E & G	Yes	RS	1.87	0.15	0.21	0.23	Yes	RS	0.52	0.83	0.54
Southern California Edison	Yes	R	3.74	0.47	0.52	0.59	Yes	R	0.39	0.51	0.76
Southern Colorado Power	Yes	R	1.47	0.11	0.14	0.17	No	—	—	—	—
Southern Company	Yes	R	1.81	0.20	0.25	0.30	Yes	R	0.31	0.18	0.07
Southern Indiana G & E	Yes	R	2.42	0.38	0.52	0.65	Yes	R	0.50	0.46	0.23
Southwestern Electric	No	—	0.93	—	—	—	No	—	—	—	—
Southwestern Public Service	No	—	1.73	—	—	—	Yes	RS	0.51	0.34	0.18
Tampa Electric	Yes	RS	1.78	0.40	0.46	0.52	No	—	—	—	—
Texas Utilities	No	—	2.73	—	—	—	Yes	RS	0.52	0.42	N.A.
Toledo Edison	Yes	R	1.12	0.10	0.14	0.18	Yes	R	0.32	0.32	0.26
Tucson Gas Electric L & P	Yes	R	1.02	0.13	0.18	0.23	No	—	—	—	—
Union Electric	Yes	R**	1.77	0.14	0.21	0.23	Yes	R	0.18	0.15	0.09
United Illuminating	Yes	D	1.64	0.18	N.A.	N.A.	Yes	R	0.10	N.A.	N.A.
Utah Power & Light	No	—	1.75	—	—	—	Yes	RS	0.03	0.03	0.03
Washington Water Power	Yes	Flo	2.33	0.13	0.20	0.21	Yes	RS	0.09	None	None
West Penn Electric	Yes	RS	2.25	0.07	0.09	0.13	Yes	RS	0.25	0.26	0.13
Western Massachusetts Cos	Yes	R	1.67	0.17	0.18	0.20	Yes	R	None	None	None
Wisconsin Electric Power	No	—	2.12	—	—	—	No	—	—	—	—
Wisconsin Power & Light	Yes	R	2.03	0.17	0.23	0.30	Yes	R	0.41	0.17	0.06
Wisconsin Public Service	Yes	R	1.77	0.13	0.21	0.25	No	—	—	—	—

*** — Used "flow through" in 1958
R — Normalized in reserve
RS — Normalized in restricted surplus
D — Normalized in depreciation reserve
ADT — Normalized as accumulated deferred taxes
Flo — "Flow through"
av — Based on average shares outstanding
d — Domestic subsidiaries only
t — Total of deferred taxes in 1958, both liberalized depreciation and accelerated amortization.
N.A. — Not available

Starr Attacks 'Myths' About Nuclear Power

"We have today many myths that surround . . . development of atomic energy." The speaker was Dr Chauncey Starr, general manager of Atomics International Division of North American Aviation. Last month he told the Nuclear Energy Writers Association what he considered these myths to be, and then set about disproving them. Here is Starr's catalogue of the mythology of A-power:

Nuclear Power

Atomic power will bring electricity at no cost to the public. This idea is at last losing favor, according to Starr, but today a similar myth is growing up around fusion power. "From the simple basis that the oceans of the world contain an enormous amount of hydrogen isotopes, an illusion has again been created that fusion will one day bring no-cost power to all," he said, in spite of the fact that high costs of fusion equipment outweigh the fuel costs.

A-power will revolutionize the economies of underdeveloped countries. This myth has "had an evangelistic appeal to the international political fraternity," Starr said. Although it has tarnished since the first Geneva Atoms-for-Peace Conference in 1955, "many small countries whose economies and manpower skills could barely support minor educational, health, and industrial growth were stimulated to devote significant portions of their strength in an attempt to establish atomic energy facilities; presumably as status symbols, if nothing else."

STARR

Among the myths that are still widely accepted as fact, Starr cited two that fall into the "technical" category and three that affect policy. Many technical authorities overstress the importance of breeder reactors because they produce fissionable fuel, he said, although the amount of fuel produced would probably not balance their high cost. He added that our economic resources of thorium and uranium could be expanded greatly through small increases in the price per pound customers are willing to pay for the ore.

Higher steam temperatures necessarily will bring lower power costs. Starr called the quest for high temperatures a "philosophic gimmick and technical prestige goal" of utility engineers. He said that this philosophy did not always work when higher temperatures meant more expensive plant, but that it had "caused automatic acceptance of reactor concepts with a high temperature potential, without the [utility] industry's customary cautious examination of over-all economics."

Nuclear plants should be built where power costs are high. Starr said that the same things that make conventional power costs high "may very well increase the relative cost of nuclear power." European power costs are high because of low load factors and high taxes on fuel, he said, yet European A-power cost calculations assume maximum use of plant and minimum taxes. "If an atomic power station were to operate under similar load conditions and bear a similar tax burden, the cost of power produced by it would probably bear the same relation to conventional power cost in Europe as it does in this country."

In the U. S., two myths have clashed, Starr said. "The first was that atomic energy was a great bonanza of national wealth which had been discovered and developed with public funds and therefore belonged to the people as a whole. The second was that private enterprise could conduct the development of any field more successfully than the government." Today, said Starr, the conflict has subsided and a compromise situation is developing in which the government is undertaking as a national investment the broad development of the field, private industry is making investments to establish its commercial position for the future, and the utility industry is participating to an extent consistent with its resources." Starr suggested that government-supported experimental and prototype plants be placed in the utility grids to afford operating and maintenance experience.

Long-Life features give Victor suspensions Life-Long performance

WILL LAST LONGER THAN YOU WILL

Men who purchase insulators are enthusiastic about the service records of Victor Suspensions. We're not surprised. Victor Suspensions are laboratory designed, manufactured under rigid quality controls and tested with the industry's most modern equipment. Don't forget, insulators have been manufactured at Victor since 1893 and insulator quality has been improving constantly ever since. To Victor, porcelain insulator-making is a science. Scientific methods together with meticulous attention to detail assure the finest insulators available. Put up a Victor Suspension today and chances are **you** won't ever replace it—it will last that long.

HOW TO CEMENT A REAL FRIENDSHIP

You just don't go out and buy a bag of ordinary cement for bonding insulator caps and pins to insulator bodies. No sir! The cement used in giving a 15,000 lb. Victor insulator double its rated strength, is a special type, premium grade cement carefully compounded specifically for use in insulator manufacturing. It costs more, but it is one big reason why a Victor Suspension with a rated mechanical and electrical strength of 15,000 lbs. can undergo pulls almost double its rating, before failure.

This is an important feature for any buyer of suspension insulators. It means that, when you install them on your lines, you have taken out a valuable insurance policy against the damage which can be wrought by high winds and ice.

Effect of all this careful attention to detail is not only a better insulator, but a mighty close and friendly relationship with our customers. There's nothing like a good product to cement real friendship between consumer and supplier.

VICTOR NO. 900
SUSPENSION INSULATOR

WE DRAW A BEAD ON BREAKAGE

No, we don't deliberately shoot at our insulators but we **do** safeguard our suspensions from breakage by special contours of the skirts. Take a good look at a Victor Suspension and you will notice that the edges of all corrugations (beads) are made extra thick in order to provide extra impact strength where such strength is most needed.

This feature of design together with the use of Purified Porcelain bodies provides an extra margin of accident insurance which any insulator buyer can appreciate.

OUR FACTORY IS FULL OF BABY SITTERS

Well, not actually in the common sense of the word. But we certainly do baby sit on every step of our manufacturing operations. Do you realize that in the manufacture of a "simple" Victor Suspension insulator there are almost fifty operations involved, practically every one of which comes under the Victor department of quality control. Such an intensive quality control program as this requires a lot of man-hours by a lot of people . . . constant study by our supervisors to keep abreast of the latest developments in this essential field. That means that Victor employs a lot of people who do nothing but watch manufacturing operations and maintain the high quality control standards which prevail in the Victor plant.

Result of such careful concern with quality: insulators that greatly exceed EEI-NEMA standards, have tremendous built-in margin of safety, that look better, perform better and last longer.

YOU GET TWICE THE INSULATOR YOU PAY FOR

Victor Suspension insulators are designed and built to support tons of ice-coated, wind-swept conductor without failure. Caps and pins are on to stay—won't let go when they're needed most. Insulator bodies are made of Purified Porcelain . . . purest, hardest, strongest insulator porcelain ever made! Pull tests in the Victor laboratory show that Victor Suspensions withstand up to twice their EEI-NEMA ratings. That's why, when you buy Victor Suspensions, you buy practically twice the insulator you pay for . . . why Victor is the power man's best bargain! For details, write I-T-E Circuit Breaker Company, Victor Insulator Division, Victor, N. Y.

I-T-E CIRCUIT BREAKER COMPANY
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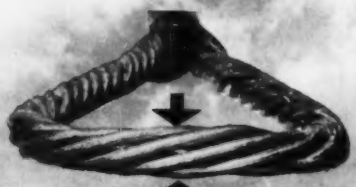

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DEPENDABLE PRODUCT

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GUY-GRIP dead-ends OFFER YOU:

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2 Easier tensioning for down-guying & span guying

3 Smoother contouring... more adaptable for multiple guying

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Enjay Butyl is used in General Electric washers and refrigerators because it offers economy and outstanding all-round quality performance.

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Supplier Guarantees Street Lighting Levels

TOM LYNN, Lighting Specialist, Southwestern Public Service Co, Amarillo, Texas

Southwestern Public Service Co has placed the responsibility for mercury vapor street lighting performance on the equipment supplier.

Southwestern furnishes, installs and operates street light units for municipalities in its service area on a fixed monthly fee per unit basis. Promotion of this service is through improved lighting system performance. This has spurred wider use of mercury light sources and horizontal luminaires, and caused development of a guaranteed performance specification. The utility's specification ensures proper initial application of horizontal mercury luminaires and acceptable maintenance of lighting levels for a period of a year.

Street lighting is designed to provide a certain footcandle level, dependent on street width, mounting height, and unit spacing. Suppliers are provided with this specific data plus the desired luminaire type.

The specification requires each bidder to calculate application of the equipment he proposes to supply to the specified conditions, and to guarantee initial and maintained ft-c levels for a specific period.

Each installation is actually tested in service by Southwestern personnel (See photo). An intial test is made after ten nights or about 100 hours. A second test follows after about one year or 4,000 hours. If measured results show less than guaranteed ft-c levels, the supplier is furnished test data and makes the necessary changes to meet the guarantee.

Tests comply with the IES "American Standard Practice for Street and Highway Lighting" which requires measurements on 10-ft centers along each traffic lane. Readings are taken at road surface by street lighting meters having dual scales calibrated for 0—1.5 ft-c and 0—5 ft-c. Use of two meters gives a double check in minimum time.

Data are recorded on a print of the test area. Readings are averaged and correction factors applied for the various lamp types.

Silvray Promotion To Help Utilities Double Lighting Load

A campaign to help utilities double commercial and industrial electrical revenue in the relighting market has been instituted by Silvray Lighting, Inc.

Key of the program is the recommendation of 200 footcandles as the desirable level of illumination. One of the program objectives is to link an awakening of the "sleeping giant" —the relighting business—with the National Lighting Bureau's present promotion, according to James M. Gilbert, Silvray president.

A teaser campaign has been directed to 3,300 key public utility executives. During a one-week period, utility men received four tubes, each containing a scroll and tracing the history of increased candlepower requirements since 1920. The first mentioned the accepted 1920 level of 10 ft-c and the final one announced the 1960 standard of 200 ft-c. Copy said, "This means you can double your revenue from commercial and industrial lighting."

Advertising runs in Fortune magazine and trade publications.

Silvray's field staff is calling on utilities who request a "how-to" presentation.

Follow-up campaigns will be directed at electrical distributors, contractors, architects and others.

(*More Selling on p* 168)

Only Westinghouse offers all these Bonus Values in new Isolated Phase Bus

Single Insulator for Most Reliable Insulation. Use of the single insulator support minimizes the number of vulnerable points for electrical failure. Minimum short circuit stresses on insulator assured by the shielding effect of the aluminum enclosures. Resiliency of mounting brackets further limits stress on supporting insulators.

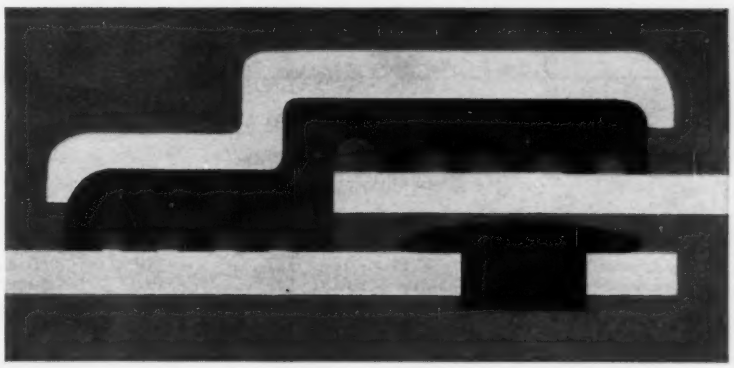
Dust-Tight Sealing Assured. Longitudinal gaskets have been eliminated. Multiple-line contact of gasketing assures perfect seal against moisture or dust entering enclosure, which maintains insulation level.

Enclosure Easily Welded in the Field if Desired. No extra parts required to weld telescoping sections for completely sealed installation initially or at a later date. The aluminum bus can also be welded for solid or flexible connections at joints.

Unique Mounting of supporting feet eliminates openings through the enclosure that would require subsequent sealing.

For further information, call your Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60972

Pressure Applied Directly to Gasket for Best Seal. Specially extruded, continuous neoprene rings provide a series of narrow band contacts for excellent seal around full circumference of housing. The clamping band of heat-treated extruded aluminum alloy gives uniform pressure on sealing ring. Plastic spacers insulate housing against circulating currents at joints. Adequate clearance between inside and outside housings makes telescoping easy.



YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Mr. H. H. Rugg, Assembled Switchgear Design Engineer, points out simple, sturdy support for Westinghouse Isolated Phase Bus housing and insulator.

Two-Rate Meter Tests Heating Characteristics

A Massachusetts home owner, faced with the problem of replacing a hot water heating boiler and an oil burner, switched to electric heat. Result: Less purchase and installation cost, and greater satisfaction with performance because of cleanliness and even heat control, compared to the former method.

The total cost was about $1,100, or less than the expense of getting a new boiler and another oil burner.

Energy Consumption for Electric Heating

	Kwhr	Cost
1956		
December	2,568	$39.29
1957		
January	3,855*	58.98
February	4,509*	68.99
March	2,487	38.05
April	3,241	49.59
May	952	14.57
June	341	5.22
July	0	0
Totals	17,953	$274.69
August	0	0
September	0	0
October	370	5.66
November	1,096	16.77
December	1,374	21.02
1958		
January	2,923	44.72
February	1,428	21.84
March	1,751	26.79
April	1,193	18.25
May	442	6.76
June	153	2.34
July	74	1.13
Totals	10,804	$165.28

* Demand reached 10 in these months

Division of Heating Load

	7 am–11 pm Regular	11 pm–7 am Off-peak	Total	Cost
1958				
August	0	0	0	$ 0
September	24	8	32	.49
October	495	212	707	10.82
November	419	561	980	14.99
December	555	999	1,554	23.78
1959				
January	704	1,723	2,427	37.13
February	487	1,577	2,064	31.58
March	667	1,287	1,954	29.90
April	364	740	1,104	16.89
May	302	635	937	14.34
Totals	4,017	7,742	11,759	$179.92

Energy used from Aug. 14, 1958 to May 13, 1959—11,759 Kwhr
Between the hours of 7 am–11 pm—4,017 or 34.2%
Between the hours of 11 pm–7 am—7,742 or 65.8%

The home is a 7-room, 2-story wooden Cape Cod with insulated roof and gable ends. The house is 33x27 ft in plan, with 891 sq ft per floor and an 8-ft stud. The first floor is not insulated.

The electric heating installation is supplied at 240-v, 3-wire, single-phase service. To obtain accurate information as to demand, energy consumption, etc, a separate meter was installed at the start of the electric heating installation to measure electric heating alone. Then on September 10, 1957, a 2-rate meter was installed to enable the heating load to be measured on a regular and an off-peak consumption basis.

The units, manufactured by Continental Radiant Glass Heating Corp, consist of two 1,500-w and eleven 1,000-w permanent units with printed heating elements, and one 1,000-w portable unit. Permanent units are installed under the windows. The bottom of each is 4 in. above the floor. Each room is separately controlled by its own adjustable thermostat.

Charts Show Heat Consumption

Charts (left) show energy consumption for heating the home for various months, along with the net costs. The kwhr demand records for heating were omitted after July, 1957, but from month to month the heating bills and energy required for that service are given. From August 14, 1958 through May 13, 1959, the tabulation shows that the heating load was divided into the regular (7 am to 11 pm) and off peak (11 pm to 7 am) periods. Only 34.2% of that load was "regular" while 65.8% was "off peak."

House heating is billed at present on the Danvers Electric Light Department's domestic rate of 1.7¢ per kwhr for all consumption over 200 kwhr per month, or 1.53¢ net.

Comparing costs in winter with costs in summer, the customer used a total of 3,232 kwhr for heating and other energy at a net cost of $35.77, or 1.68¢ per kwhr in December, 1958. Last August he used no electric heating service, but his total use of electricity in that month was 406 kwhr at a cost of $9.54 or a net rate of 2.34¢ per kwhr.

Executive VPs Named at Atlantic City

HAYWARD

Carl O. Carlson and James P. Hayward have been appointed executive vice presidents of Atlantic City Electric Co.

Carlson was first employed by the company in 1926 as a distribution engineer. He was named superintendent of electric operations in 1948, and became vice president of that department in 1952. In 1957, he was elected senior vice president.

Hayward joined the company in 1925. He was promoted to distribution engineer in 1937, and to superintendent of transmission and distribution in 1948. In 1957, he was named vp-electric operations and vp-commercial in 1958.

CARLSON

Hanson Made Vice President of NEES

Harry Hanson has been named vice president of the New England Electric System. For the past 24 years he has been treasurer of the System and most of its subsidiaries, and will continue in that financial post.

Hanson joined New England Electric in 1918 as a clerk and rose through the ranks serving as an accountant and later assistant treasurer.

At 35 he became one of the youngest top financial officers in the electric utility field.

Olson: Worthington VP; Burris: Subsidiary President

R. H. Olson, former president of Electric Machinery Mfg Co, has been elected a group vice president of Worthington Corp, the parent corporation of E-M since 1944. He was also elected chairman of the board of Electric Machinery Mfg.

Arthur P. Burris has been elected president and general manager of E-M, and C. E. Buchan has been named sales vice president.

Olson joined the company in 1918 and first served as manager of the St. Louis and New York district offices. He later served as sales vice president and became the president of Electric Machinery Mfg Co in 1950.

Burris joined E-M in 1930 and was successively Minneapolis, Kansas City, and New York district manager. He became vice president-sales in 1950.

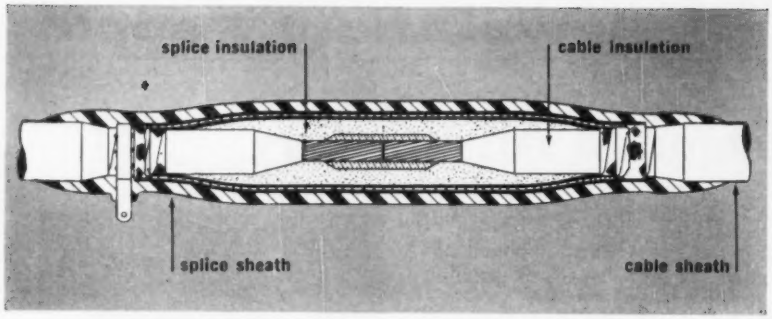
Buchan was Cleveland district manager for 30 years, and became general sales manager in 1954.

OLSON

BURRIS

BUCHAN

(*More News About People, p* 170)



The theory behind the design of "fail-proof" cable splices

Designing "fail-proof" splices . . . or, putting it another way . . . how to obtain splices that are as dependable as the cables they connect, is a subject that electrical engineers have studied for a long time.

The problem. The conductor of an electrical cable is insulated and sheathed with compounds designed specifically for the job, and they perform this job throughout the length of the cable. In splicing, however, portions of the insulation and sheath must be removed to enable the conductor ends to be joined together. Replacing these compounds with equally reliable materials is the basic problem in making a "fail-proof" splice.

An interesting observation. Many splicers replace the cable's insulation and sheath with tapes that have a hundred other purposes. A common opinion is "tape is tape—the cheapest is good enough." This opinion is one of the reasons behind the fact that most cable failures occur at the splice. Obviously, splices are not failproof if they're covered with materials that were not specifically formulated to insulate or sheath cables.

The solution. Fortunately, there are splicing tapes made of true cable compounds. These tapes are made by Okonite, the company that manufactures and designs superior electrical cables and the splicing tapes to go with them. Okonite tapes have been tested in the laboratory and proved in the field . . . and they are made by a cable manufacturer specifically to sheath and insulate cable.

Try Okonite Quality tapes. You'll be glad you did, and your splicers will, too. They'll appreciate the fact that Okonite tapes are easier to work with. *Okonite* and *Okolite* tapes for insulating, *Okoweld* and *Okoprene* for sheathing.

THE OKONITE COMPANY

Subsidiary of Kennecott Copper Corporation

Passaic, New Jersey

Logan Appointed VP at Simplex Wire & Cable

John W. Logan has been appointed a vice president of Simplex Wire & Cable Co.

Logan was with General Electric Co from 1931 to 1953 in capacities which included assistant to the vice president; general sales manager, apparatus department; and manager, application engineering and assistant to the general manager of the Knolls Atomic Power Laboratory.

In 1953, he became president of Cambridge Corp.

Brown Elected VP of Joslyn Mfg & Supply

George B. Brown (above) has been elected a vice president of Joslyn Mfg & Supply Co.

He joined the organization in 1935 and was appointed sales manager of the central division in 1955.

M. C. Zwang has been appointed sales manager of the central division and Robert K. Hayman assistant sales manager.

OSBORN

RENTON

Interstate Drop Forge Names New VPs

Hershel C. Osborn has been named senior vice president and Stanley J. Renton, vice president and plant manager of Interstate Drop Forge Co. Werner G. Bartell has been made treasurer and assistant secretary.

Osborn had been vice president and plant manager since 1938, and a director since 1939. He joined the company in 1925 as superintendent. Renton joined Interstate in 1936, served as assistant superintendent from 1945 to 1958, and was superintendent for the past year. He has also been elected to the board of directors.

Hollingsworth Named General Sales Manager

Thomas Hollingsworth has been appointed general sales manager of Hubbard & Co.

He was most recently director of marketing for Electrical Engineers Equipment Co, a Hubbard sub.

Before joining Hubbard, he was manager of product planning for Westinghouse Electric Corp.

Burndy Corp Names Jones Vice President

John F. Jones, (above) formerly president and director of H. H. Buggie, Inc, has been named vice president of Burndy Corp. George A. Goos, former vice president and director of Buggie, has been named assistant secretary of Burndy. Buggie was recently acquired by the Burndy Corp.

(*More News About People on p* 172)

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

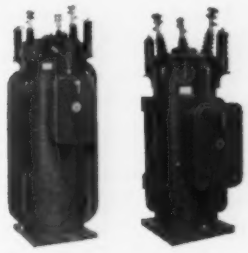
SAFER

WESTINGHOUSE 1¼%-STEP REGULATORS

Do you always know . . . for sure . . . the position of the tap changers in your regulators? You can, with the Westinghouse position indicator which gears down from a higher speed cable drive. This eliminates drive cable error, prevents danger of bypassing off-neutral position. Dial can easily be read from the ground.

In addition, where load range selection is used, internal indicator detents prevent movement of limit switches from set position to provide positive range limits.

Here is more evidence that Westinghouse feeder voltage regulators are safer to operate, assurance that you can offer better service . . . all the time. J-70901



Westinghouse URF and URL single-phase feeder voltage regulators

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I wish we had more personnel and time to prepare this study for a new power plant and site.

Your regular staff is overloaded now. Call in the specialists and let them carry the peak load. How about Pioneer?

Give your non-routine operations to Pioneer

Design and Consulting Engineering Services. Pioneer has specialized in designing power plants for 57 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters. Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services. Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!
On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes Pioneer's engineering services, and corporate services, from financing to operation.

57 YEARS

Pioneer Service & Engineering Co.

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Mallett Named VP of Moloney Electric

Moloney Electric Co has named M. B. Mallett vice president in charge of commercial application.

Before joining Moloney he was manager of English Electric Co, St. Catherines, Ontario.

Briggs Elected VP at Continental-Diamond

Continental-Diamond Fibre Corp has elected Arthur J. Briggs a vice president. Previously general sales manager, he has been with CDF for 33 years.

He started as a sales correspondent in the company's Toronto and Bridgeport plants and was later a salesman in the Cleveland and Cincinnati sales territories.

He also served as resident manager of the Detroit sales office and later as district manager for both

END
TREE-TRIMMING
PROBLEMS

By using aerial (field spun) cable for distribution lines, practically all tree-trimming is eliminated during the installation and for the rest of the cable life.

The freedom from maintenance experienced with this type of installation makes it a very economical distribution plant.

★ ★ ★

For descriptive literature on tools for spinning aerial cable, write or phone

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Phone CE 2-7234

CABLE SPINNING EQUIPMENT CO.
Topeka Kansas

the Cleveland and Chicago district sales offices. In 1956, he became general sales manager in the Newark, Del., headquarters.

Union Carbide Names Haile Vice President

William M. Haile (above) has been made a vice president of Union Carbide Corp. He was formerly president of Linde Co, a division of Union Carbide. William B. Nicholson succeeds him as president of Linde.

Haile joined Union Carbide in 1925 in the New Orleans office of Linde. He became manager of the eastern region in 1952, vice president in 1955, and president in 1957.

PERSONAL BRIEFS

Kansas Power & Light Co has appointed **C. C. Hoke** assistant division manager. He will assume his new position in mid-August.

Walker Lee Cisler, president of the Detroit Edison Co, has been named to lead the American Society of Mechanical Engineers. He heads a slate of four vice presidents. The new officers will be installed in December, during the ASME's annual meeting, following a mail ballot of the Society's members. The other nominees are: **Charles H. Coogan,** professor and head of the mechanical engineering department, Uni-

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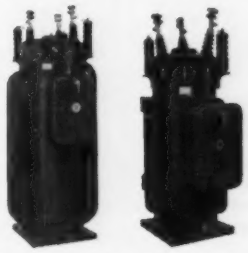
WESTINGHOUSE 1¼%-STEP REGULATORS

Are your regulators rugged enough to meet *all* the conditions they're likely to encounter over a long period of service? Well, here is an exclusive Westinghouse idea that greatly lengthens contact life. Westinghouse regulator contacts are designed to give maximum contact life under all conditions. Higher current ratings make use of a unique magnetic effect to multiply contact pressures under short circuits to prevent burning. Normal contact pressures are maintained under usual operating conditions to prevent galling.

With Westinghouse voltage regulators, you get this and many other exclusive benefits that mean longer, more dependable service. For full details, call your Westinghouse representative. J-70922



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Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

versity of Connecticut; **William C. Heath,** director of market development, Solar Aircraft Co; **Donald E. Marlowe,** dean of the school of engineering and architecture, Catholic University of America; and **Henry N. Muller, Jr,** vice president, Canadian Westinghouse Co, Ltd.

Lieut Gen James D. O'Connell, who recently retired from the post of Chief Signal Officer, U. S. Army, has become a consultant to General Telephone & Electronics Corp.

American-Standard Industrial Division of the American Radiator & Standard Sanitary Corp has appointed **C. K. Ferguson** as manager, advertising and sales promotion.

Commissioner Frederick Stueck of St. Louis, Mo., took the oath of office for his second five-year term as a member of the Federal Power Commission.

Allyn W. Falls, management consultant, is now associated with Ebasco Services Inc, in the San Francisco office.

The following executives in the industry have been cited recently. **Philip A. Fleger,** chairman of the board and president of the Duquesne Light Co, has been selected as Western Pennsylvania's outstanding industrialist for the year 1959 by the Western Pennsylvania Chapter of the Society of Industrial Realtors . . . **Murray Joslin,** operating vice president in charge of engineering, construction, production, and research and development of the Commonwealth Edison Co, was the 1959 winner of the Marston Medal. The medal is awarded annually by Iowa State College in memory of the late Dean Anson Marston of the Division of Engineering to an alumnus in recognition of outstanding achievement in the field of engineering . . . **H. Burton Robinson,** vice president and general manager of Carolina Power & Light Co was awarded the honorary degree of Doctor of Science by North Carolina State College in recognition of his contributions to sound engineering practice in North Carolina . . . **Gwilym A. Price,** chairman of the board, Westinghouse Electric Corp, was granted the honorary degree of Doctor of Laws by Lehigh University. He was cited for his contributions to higher education by the university . . . **Walker L. Cisler,** president, Detroit Edison Co, received an honorary Doctor of Engineering Degree from Stevens Institute of Technology, Hoboken, N. J. . . . **Henry F. Dever,** vice president, Minneapolis-Honeywell Regulator Co, was awarded an honorary Doctor of Science degree by Bradford Durfee College of Technology, Fall River, Mass. . . . **Bern Dibner,** president, Burndy Corp, was awarded an honorary degree of Doctor of Engineering by Polytechnic Institute of Brooklyn, N. Y. . . . **J. Ernest Smith,** vice president and director, Datamatic Division of Minneapolis-Honeywell Regulator Co, has been awarded an honorary Doctor of Science degree from his alma mater, Jamestown College in North Dakota.

Joseph C. Egg has been named manager, valuation and property records section, accounting department of the Duquesne Light Co.

Walter D. Skinner has been appointed manager of Pacific Gas & Electric Co's Drum Division, headquartered at Auburn, succeeding **Ramon A. Cayot** who has retired.

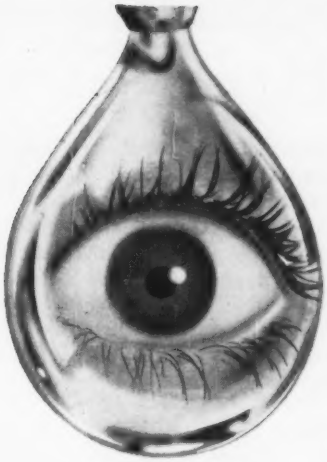
Montana Power Co has appointed **O. J. Horrom** assistant general sales manager.

Eben Wright Pyne, president of the First National City Trust Co, has been elected a director of the Long Island Lighting Co.

Southwestern Electric Power Co has named **Erskine J. Best** Louisiana distribution engineer.

William R. Ibach, a substation engineer for the Wisconsin Electric Power Co has been elected chairman of the Milwaukee section of the American Institute of Electrical Engineers.

Duke Power Co has appointed **Robert F. Dorton, Jr,** superintendent of the Greenville production and transmission district. **E. R. McKnight** has been named his assistant. **H. S. Wilson,** electrical superintendent of the Anderson branch has been named an assistant to J. D. Henry, manager of the Greenville branch.



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AutoAnalyzer®

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The Technicon® AutoAnalyzer® is a round-the-clock watchman protecting the generating efficiency of power plants. Like a "Little Brother" it keeps a continually curious eye on the boiler feed water passing by... automatically analyzing it to insure that characteristics are near-ideal for maximum steam-generating potential with minimum corrosion and scale.

A brochure and application data tell the whole story of this automatic "water watch." Send *today*.

*Such as: Consolidated Edison of N.Y., Niagara Mohawk Power, Detroit Edison.

TECHNICON CONTROLS, INC.
CHAUNCEY, NEW YORK

Alex McKeigney, former assistant to the president of Mississippi State University, has joined Mississippi Power & Light Co as administrative assistant in the executive department.

Connecticut Light & Power Co has elected **Traver L. Berry** controller, succeeding the late Leo A. Mayo. Company has named **W. Lindsey Booth,** manager at East Hampton, as executive assistant to Robert P. Stacy vice president in charge of administration.

Duane Gorman has been advanced to the new position of division coordinator Monongahela Power Co. ... Merwin M. Brandon, chairman of the National Electrical Code Committee, has named **Buford H. Martin** of the Tennessee Valley Authority, chairman of Code-Making Panel 10.

Public Service Co of Indiana has appointed **Charles W. Campbell** assistant general counsel.

Housatonic Public Service Co has named **Edmund Strang** district manager in Derby and **Richard Voegele** superintendent of the power plant.

Benjamin H. Lynn has retired from the Black Hills Power & Light Co.

Several changes have been made at the Ohio Valley Electric Corp recently. They are: **W. Frank Neff** became superintendent of electrical operations, **James G. Cox** executive assistant to the vice president, **John S. Foster,** staff engineer-production, and **Walter M. Cornett** acting director of personnel.

B. S. Gordon, district manager of Gulf Power Co's operations in Panama City, will retire on August 1. He will be succeeded by **D. R. Hinton, Jr** . . . Potomac Light & Power Co has named **P. W. Jenkins** foreman of the service department.

Avery R. Schiller, president and general manager of the Public Service Co of New Hampshire and 1958 winner of the Manchester Chamber of Commerce "Man of the Year" award in 1958, has accepted the chairmanship of the arrangements committee, National Defense Re-

(*Continued on page* 176)

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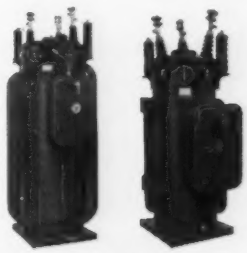
In addition to dependable operation, convenience and versatility are reasons that make regulators more valuable to you. With pad- or platform-mounted URF units, for example, Westinghouse supplies a hand crank for manual operation of the tap changer. Positions may be changed with the regulator de-energized or motor circuit inoperative.

For data on this and many other exclusive convenience features of Westinghouse regulators, get in touch with your Westinghouse representative. J-70923



Westinghouse URF and URL single-phase feeder voltage regulators

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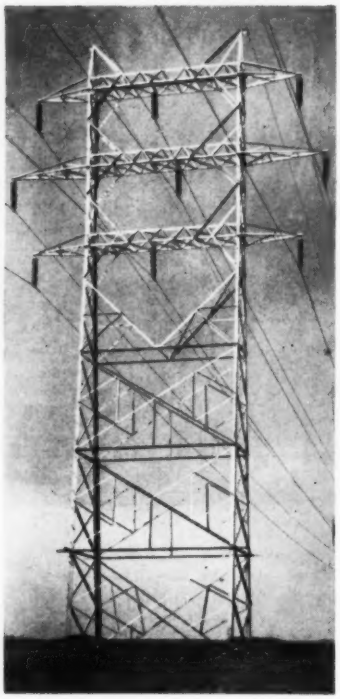
TOWERS

by

FLINT



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TULSA, OKLA. MEMPHIS, TENN.

sources Conference to be held in Manchester, N. H., on Oct. 19-30.

C. P. Smith, assistant treasurer of Georgia Power Co, retired July 1.

Commonwealth Services Inc has appointed **Robert Kyle** as a general consultant, specializing in operational and management studies.

J. Manuele, director, headquarters quality control, Westinghouse Electric Corp, has been named chairman of sectional committee B46 of the American Standards Assn. He represents the National Electrical Manufacturers Assn on the committee.

Joseph R. Wetch has been appointed to the Research Advisory Committee, National Aeronautics and Space Administration. He is project engineer for compact power plants at Atomics International, a division of North American Aviation, Inc.

Andrew C. Verock has been appointed chief engineer, pole line hardware, Hubbard & Co. **Robert L. Reese** has been elevated to manager, product development.

Southern States Equipment Corp has elected **T. A. Burdeshaw,** vice president-engineering, to the board of directors.

Dr. Lauchlin M. Currie has been elected a director of The Babcock & Wilcox Co.

Allis-Chalmers Manufacturing Co has made these appointments: **Edward V. Trunk** to the transformer development laboratory at the Terre Haute, Ind., Works; **Ronald H. Kuhlman,** assistant engineer to the core engineering group of the nuclear power department; **Joe S. Caruso** to the motor-generator department; and **Charles S. Rogovin** to the mechanical design section of the steam turbine department.

Carl L. Powell has been named general manager, western division of Day-Brite Lighting, Inc.

J. Franklin Anderson, Continental-Diamond Fibre Corp has retired.

Thomas M. Brickley has been named Milwaukee district manager office of the Okonite Co.

W. Lyle Donaldson has been named chairman of the Department of Electrical Engineering at Southwest Research Institute.

General Electric Co has named **Richard L. Schmidt** to the newly established position of manager of government research and development applications for the Atomic Power Equipment Dept. **Vice Admiral Willard A. Kitts,** retired from his post as manager of the Atomic Products Study of the Atomic Products Division.

Federal Pacific Electric Co has elected **Edward Bierma** secretary-treasurer, a new office with combined responsibility for both legal and financial activities. Controller and Assistant Treasurer **Harold E. Young** has assumed responsibility for the technical phases of the company's financial activity with **William J. Landrigan** functioning as assistant controller specializing in budget control and procedures. **Lester Deschenes** replaces Landrigan as accounting manager for the company's Manufacturing Division composed of four plants in Newark, N. J., and Scranton.

I-T-E Circuit Breaker Co has made these personnel changes. **John P. Bennett** has been made manager of marketing research, a new corporate staff position, and **Gerald E. Hertig** has been appointed consulting engineer EHV Systems. Company has retired **Ralph G. Lockett** western regional sales manager.

E. Albert Wagner has been named manager of the Service Engineering Division of the Electric Storage Battery Co.

Nicholas K. Delaney has been appointed by Line Material Industries to the new position of product manager-switchgear and capacitor sales.

Aluminum Co of America has made these recent appointments: **Thomas O. English** to general purchasing agent for Alcoa and its subsidiaries. The responsibility for sales of all Alcoa aluminum conduit now is being transferred to Rome Cable Corp, which recently became an Alcoa subsidiary. **Dixon Lewis,** Alcoa's assistant manager of electrical conductor sales, has been

named product manager of conduit for Rome Cable.

Promotion of **Burton F. Danielson** to electrical insulation sales manager, maintenance and construction trades, has been announced by Minnesota Mining & Manufacturing Co.

General Electric Co has made these organizational changes: **G. L. Roark** to manager of marketing in the high voltage switchgear department; **Raymond C. Allen** to manager of engineering at the instrument department in West Lynn, Mass.; **A. L. Hammett** to manager of product planning and product service for the meter department in Somersworth, N. H.; and **C. M. Daly** to manager-marketing administration and personnel development for the portable appliance department in Bridgeport, Conn. Company also announced the retirement of **Dr Kenneth H. Kingdon** from the GE Research Laboratory.

Westinghouse Electric Corp has made the following new assignments: **Dr John W. McNall** to director of research for the Lamp Division; **Burr Tupper** to director of works engineering, and **Kent B. Froehlich** to general service manager for the appliance sales.

William A. Rotunno has been appointed marketing specialist — Panelecent lamps for Sylvania Lighting Products, a division of Sylvania Electric Products, Inc.

Anderson Electric Corp has made **Samuel J. Spurgeon** manager of the Utility Engineering Division and Laboratories.

Underwriters' Laboratories, Inc, has promoted **H. B. Whitaker** to vice president and chief electrical engineer with headquarters in New York.

Philco Corp has named **Alan O. Mann** to the newly created position of commercial coordinator-computer and automation department of the company's Government and Industrial Division. Company has promoted **Norman O. Bender, Jr,** to the newly created position of operations manager for Transac computers in the Government and Industrial Division. **L. G. Becker** has been appointed eastern regional manager for the Government and Industrial Division.

Four promotions in the purchasing department of the Blaw-Knox Co have been made. They are: **William G. Blessing** to director of purchases; **Bernard R. Lauer** and **Wayne Rawley, Jr,** assistant directors of purchases, and the consolidation of purchasing of the Aetna-Standard Division into the foundry and mill group, and the appointment of **Cal R. Wood** as purchasing agent for the group.

Continental-Diamond Fibre Corp has appointed **Robert S. Handly** as manufacturing manager of its operations in a tri-state area, and **Edward F. Heffernan, Jr,** as Bridgeport, Pa., plant manager.

OBITUARY

Henry H. Kerr, 67, former vice president of the Toledo Edison Co . . . **Curtis M. Colvin,** director of advertising of Duquesne Light Co . . . **Thorsten A. Fjellstedt,** 61, manager of engineering power switching for Line Materials Industries . . . **Stanley M. Brown,** 57, Philadelphia plant manager for the Industrial Division of the Electric Storage Battery Co.

Ralph N. Hill, board chairman and former president of Green Mountain Power Co . . . **James M. Blackford,** division sales engineer at CL&P . . . **William E. Turner,** 82, Public Service Co of Oklahoma . . . **William Ingram, Jr,** 47, an engineer with the Potomac Electric Power Co . . . **John Williams Carpenter,** 77, former chairman of the Texas Power & Light Co . . . **Arthur Lucas Jones,** 80, retired commercial vice president of General Electric Co . . . **Joseph Franz,** consulting electrical engineer.

Chester Melvin Ewing, Public Service Co of Oklahoma manager at Cheyenne since 1939 . . . **Chester H. Steele,** 65, vice president in charge of western operations for the Anaconda Co.

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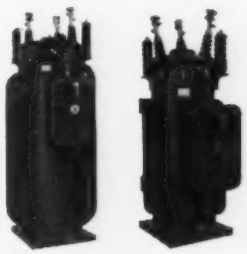
This is just one reason why a Westinghouse regulator can lead a longer and more useful life on your distribution line. For more facts, call your Westinghouse representative.

J-70924



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requirements are satisfied may be a costly mistake. Economic considerations of line losses and reactive supply requirements should also be considered. Earl Hazan, Kaiser Aluminum & Chemical, presented resistance, temperature, and current characteristics of 8 frequently used EHV conductors in support of his statement.

W. M. Pixley, Jr., Pacific G&E asked whether aluminum could be operated higher than 75 deg. and suggested that data be accumulated concerning creep of all-aluminum conductors.

Study Fault Heating

Conductor performance under heavy, short-time faults can be analyzed in the laboratory by the transference concept, theorized L. F. Roehmann, Kaiser. Unlike long-time annealing where temperature and time must both be considered, time can be ignored in short-time annealing. Loss of strength occurs during the long cooling period so that the few seconds of heating is irrelevant. Therefore loss of strength can be directly related to the maximum temperature attained during the fault, he suggested.

Since temperature rise of a conductor during short-circuit is a unique function of I^2t, the value of current can be chosen in the laboratory and the period of time chosen at will. Thus stranded conductors may be tested at 1,000 amp for 2 sec to simulate 10,000 amp for 0.02 sec, he said.

In discussion, M. G. Poland, BPA, suggested that comparisons be made between aluminum and copper. Others urged that more samples of each wire be tested.

Results for conductors under tension may differ from those not under tension, warned A. Tilles, Lawrence Radiation Laboratory. And magnetic distribution within the cable and the rapid increase of resistance at the end of the heating time should not be ignored.

Develops Light for Spans

The inclination of private airplane pilots to follow rivers when visibility is poor creates a situation mutually hazardous for the airplane and power cables strung across the river, said H. J. Dana, Washington State University. In recognition of the hazard, a light suitable for operation on power line spans has been developed and tested for eight years under sponsorship of BPA.

It consists of a 9-ft neon tube with 80,000-hr life expectancy, folded into a grid to present a 2-sq-ft illuminated area. The light is attached to the power line from which it derives energy through a series transformer. It is pushed into position by a remote-controlled motor-driven trolley which locks it to the conductor, disengages, and returns to the tower. Two or more such lights on a power line effectively alert oncoming pilots.

Attenuation measurements on an energized high voltage line indicate that noise sources must be of high energy to materially affect interference level, reported E. H. Gehrig, BPA. Further conclusions were:

Attenuation may be resolved into two components approximately 0.5 db/mi and 8.0 db/mi at 1 mc.

Experimentally determined attenuation rate is considerably higher than that calculated from conductor characteristics and configuration.

Efforts should be made to increase the RF resistance of conductors thus increasing selective attenuation.

A square law radio noise meter has been developed to measure the RMS value of random noise produced by corona on a high voltage line, reported F. J. Trebby, Kaiser. The tuning range is 0.55 to 1.55 mc and sensitivity 0.10 microvolts on the lowest range.

(*More AIEE on page* 181)

NOISE METER is shown by F. J. Trebby, Kaiser, to A. S. Denholm, NRC (Can.)

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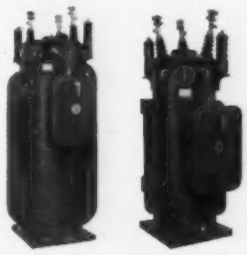

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Al Favored for Substations

Designs using new sections and alloys for structures and buses bring savings, greater resistance against corrision

Recent price shifts have made aluminum attractive as a substitute for galvanized steel in substation structures, G. W. Swanson and P.A. McCleer, Consumers Power Co, told a session on substations. After tests in the company's laboratory on four trusses built of 6061-T6 alloy to replace standard steel trusses had revealed weld failures, specifications were rewritten to use bulb angles with reduced weld stresses. Use of aluminum was extended to welded buses, junction boxes, and conduit. And inhibitors were ruled out at aluminum-steel junctions and on concrete footings. Three substations built subsequently show structural costs 11% over steel offset by 25% savings in shipping and 38% in erection, they said.

First cost of most aluminum alloy substations is higher than galvanized steel but elimination of painting and savings in erection costs offset this difference in many locations, said J. E. Williams, Alcoa, and A. D. Sangdahl, H. K. Porter Co. Placement of station equipment must be coordinated with structural design for best economy, taking advantage of special shapes and ease of fabrication, shipment and erection.

Structures should be fabricated with 6061-T6 alloy because of its corrosion resistance and strength approaching steel, they continued. They showed typical structure designs which weigh 55 to 62% less in aluminum than in steel; said the only difference is that aluminum members require more attention to B/T ratio to avoid buckling. Assembly can be with 6061-T6 cold rivets, 6061-T43 hot rivets, or 2024-T4 bolts with 6061-T6 nuts, they said. Structures used for equipment grounding should have faying surfaces coated with inhibiter and wire brushed or bonded to hold resistance low enough to protect personnel and avoid lightning damage.

All factors effecting use of aluminum in substation structures must be reviewed, said R. H. Vaterlaus, Kaiser Aluminum & Chemical. New design concepts must be devised to apply the inherent properties of new aluminum alloys, he said. Economic equality with other materials of construction requires new designs and special shapes better matched to characteristics of the metal.

Suggestions of Northern States Power Co engineers that a flat-surfaced aluminum bus be adopted has culminated in adoption of the universal angle bus conductor, reported Harold Fossum, Pioneer Service & Engineering, in a paper coauthored by L. C. Weber of Northern States Power. The 3¼-in. angle adopted has a 1,300-amp continuous rating and can withstand a 600-Mva fault at 13.8 kv when supported on 12 ft spans. Experience has shown the new construction versatile, easy to install, and more economical than any other bus conductor, they said.

Aluminum has become the standard bus for substations, said J. W. Atman, Aluminum Co of America, presenting a paper coauthored by W. J. DeWalt and D. H. Sandell. But the key to good bolted joints is the bolt assembly and its method of installation. Aluminum bolts (2024-T4) are desirable because they expand three times as fast as steel under temperature cycling and thus limit stresses. But installing them to proper tightness without a torque wrench can only be gauged by breaking a few to get the feel.

Planned Expansion Saves

Use of a uniform basic plan for its 220-66-kv substation has bought substantial economies on the Southern California Edison system, said O. R. Bulkley. Minimum breaker design, used at half of the company's 20 bulk power stations, has held 220-kv breaker requirements to 1.5 per position. Initial installation consists of two 220-kv lines and 1 or 2 transformer banks with a similar number of breakers in a ring bus. This can be expanded as required he said, observing that some large key stations are completely double-bused. Ground requirements have been cut to 13 acres but a 200 ft surround is reserved for get away.

Design includes strain bus sup-

(*Continued on page* 182)

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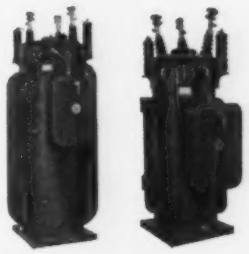

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ported by wide-flange steel structures for resistance to earthquakes, minimum insulation, and lightning arresters only where less than 3 lines terminate, he said. Transformer banks are three 30/40-Mva OA/FA single-phase units with a spare at some inaccessible locations. Other stations depend upon a railroad car with a pre-loaded transformer.

Vaporization and condensation of a fluorocarbon coolant gives a heat transfer for power transformers several times that obtainable with oil, said Paul Narbut and A. J. Maslin, Westinghouse Electric Corp, and C. Wasserman, Baltimore G&E. The new coolant is characterized by chemical inertness up to 600C, thermal stability, non-toxicity, and high dielectric strength in liquid and vapor phases. The safety aspects of such a unit could lead to placing generating station transformers directly adjacent to generators, they suggested.

In discussion, J. E. Hall, General Electric, suggested that the addition of sulfur hexafluoride to maintain dielectric strength in a cold transformer would subect it to confined vessels code regulations. But Narbut observed that a unit under construction will have load tap changing in SF_6 but still hold pressure under 15 psi. He said 115-kv design appears feasible.

A new fault pressure relay can be connected to any transformer's oil system to give sensitive and economical detection of internal faults where differential relaying is impractical, said H. A. Fohrhaltz.

Polyethylene Insulates

Buried, aerial installation proves acceptability at 34.5 kv. Ground relaying aids reliability of lower-voltage circuits

Polyethylene appears to have the insulating characteristics required for cables up to at least 69 kv, said G. J. Crowdes, Simplex Wire & Cable, in a paper read by P. H. Ware. He cited a half-mile run of 3 single conductors which has operated successfully for over two years. The cable's 350-Mcm stranded copper has semi-conducting tapes covered with 0.57 in. of high-molecular-weight polyethylene. The insulation is protected by another semi-conducting tape, a tinned-copper tape, and a 0.109-in. jacket of black PVC.

Half of this cable was direct-buried in washed sand in a 30-in. trench, Crowdes said. Risers at either end were pulled into 6-in. galvanized steel conduit. The other half was field lashed with two No. 14 bare copper wires to an aerial messenger supported by poles at 125 to 140 ft spans.

In discussion, R. C. Graham, Rome Cable, said additional savings could have been achieved by using an aluminum conductor. But K. Wyatt, Phelps-Dodge, questioned the stability of polyethylene for higher voltages.

A unique method of relaying distribution lines for ground faults has been used for over 20 yrs, especially in mountainous areas, according to Cort Lowerison and F. V. Gillum, Southern California Edison. Sectionalizing breakers with sensitive ground relaying have been used to minimize outage time and the number of customers effected. The ground relay compares the phase angle between ground-bank current and residual current in the line to which it is connected, they explained. Thus ground faults of 4 to 8 amp can be cleared anywhere in the 16-kv distribution fed from one 24,000-kva transformer.

Portland General Electric has difficulty with light ground faults, said M. A. Bostwick. Increases in the current ratings of larger sectionalizing devices is causing a gradual decrease in sensitivity of ground fault detectors, he said. And settings that are not selective with other feeder protection should be limited to areas where lower service reliability can be accepted. Zero sequence operators would otherwise be required at all sectionalizing points to assure selective protection, he said, urging that an economical zero sequence operator be developed for the larger sectionalizers.

Paul Oakes, Idaho Power, described use of a grounded autotransformer with delta tertiary to provide current for the correct polarization of ground relays. The circuits utilize only standard current transformer locations and do not require CT's within the delta.

Swing detector relays have been developed to solve local system operating problems, said J. N. Haroian, also Idaho Power. This relay incorporates a control circuit that makes use of a digital type input, a memory unit, and a program or schedule for relay operation.

Connector failures experienced in coastal areas and where aluminum conductors were connected to copper prompted thorough investigation, said W. J. Sanders, Kaiser. Field installations and laboratory tests have led to such recommendations as (1) heavy body aluminum alloy connectors with very low cop-

H. DONALD McNAIR, Leeds & Northrup, receives 2,000th badge from Registration Chairman J. V. Lamson, Bonneville Power Administration. Assistants look on

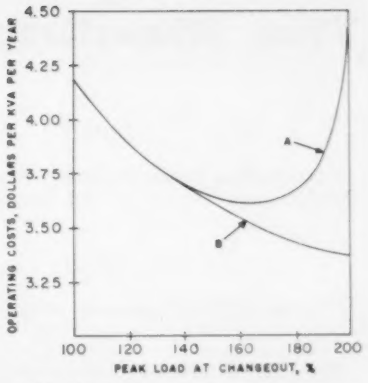
HV Distribution Cable

per content for bolted fittings, (2) aluminum bolts treated to prevent seizing, galling and corrosion, (3) aluminum compression connectors for all combinations of aluminum or aluminum-to-copper connections designed to isolate the aluminum conductor from copper, (4) use of contact sealing grease.

Exposure to salt-laden air 150 ft from the windward shore of Oahu has confirmed the performance of all-aluminum line hardware, reported T. A. Lowe, Kaiser, in a paper coauthored by M. K. Dean, Hawaiian Electric Co. Carbon steel aluminized with an alloy containing 2.5% silicon also showed only normal weathering, except near the bronze cotter key of a secondary rack, but other samples coated with pure aluminum showed evidence of rusting which might have been circumvented by a heavier coating.

The magnetic tape recorder and automatic data processing equipment give utilities a new method for load research, said G. P. Tupper, Westinghouse, and L. H. Newman, Ebasco Services. Using probability sampling and dividing customers into classes required only 375 individual load tests to obtain strata and class behavior patterns for nearly 1 million customers served by Los Angeles Dept of W&P.

Loss of life must be weighed in establishing an overloading practice for distribution transformers, said C. F. Mitchell, Commonwealth Edison, J. O. Sweeny and J. L. Cantwell, both GE. This factor causes a sharp rise in transformer operating costs per kw at well below 200% load at changeout. The minimum falls at 160 to 170% of transformer nameplate, varying somewhat for extremely fast or slow load growth rates and decreasing to near 150% for 100-kva transformers. Changing to the second larger size shows savings at high growth rates.



LOSS OF LIFE sets economical transformer changeout of 160-170% load

Space Heating Proves Desirable Load

Tests show high residential load factor and density, savings for schools and churches. Reinforcing mesh heats floor

The impact of electric heating on load in our area is no different than the equivalent amount of other residential or commercial load, D. H. Olney, Washington Water Power, told a heating session. Because of increased load density and other settings, he indicated that electric heating is a good load to sell. It has proved only 25% more costly, at 1.2¢ per kwhr, than oil or gas based upon 6,852 degree-days.

These conclusions are based upon data for 4 groups of customers ranging from those with no space heating and 7,000 kwhr average annual consumption to all-electric homes averaging 20,000 kwhr. Weekly load factor for the house heating group was 61.7% compared to 47.3% and 44.9% for two non-heating groups.

Buildings designed and built with insulation and controls specifically for electric heating enjoy a very low heat factor and operating costs well below original estimates, stated W. G. Potter, E. L. Wiegand Co. A study made jointly with Duquesne Light Co of an electrically heated school showed favorable comparison with schools heated by other fuels in the area. Electric unit ventilators and electric baseboards were used in all classrooms except the kindergarten which has electric cable in the floor. The School District saved $53,555 on construction bids by purchasing a building specifically designed for and including electric heating. Savings of $1,913 annually are credited to electrical heating.

Attempting to minimize kw demand and kwhr consumption and still meet all electricity requirements required a control system which permits temperature set-back and staggered morning warm-ups in four zones. The system was completely successful in maintaining room comfort level under all conditions. Potter concluded that electrically heated buildings on a demand rate should have a recording demand meter to provide quick evidence of equipment or operating trouble.

Problems encountered in heating church schools are similar to public schools but the church itself is a different situation, said L. N. Roberson. The conventional church nave with its high vaulted ceiling and lack of insulation presents a difficult heating problem and, as it is infrequently used, investment in heating equipment is usually minimized, he said. But churches can take advantage of off-peak rates where available. Mr. Roberson recommended more adequate insulation, radiant panel heating from floor or ceiling, and zone thermostat controls to compensate for solar gain and body heat.

Because lead-covered soil heating cable had been damaged by drilling concrete floors for anchor bolts, its use has been abandoned in shop buildings of Los Angeles Dept. of W&P, said G. E. Hutchcroft and H. P. Gluckman. Instead, rolls of electrically welded black 6 x 6-in. No. 10 mesh are cut into strips of desired length, connected in parallel and energized at 24 v to ground. About 10 days are required initially to heat the slab and its ground area to a comfortable temperature.

The Meetings Calendar

JULY

• **Southeastern Electric Exchange**—Personnel Administration Section, Grove Park Inn, Atlanta, Ga., July 30-31.

AUGUST

• **Hoosier Electronic Conference**—French Lick Sheraton Resort Hotel, French Lick, Ind., August 9-12.

• **International Association of Electrical Leagues**—24th Annual Meeting, El Cortez Hotel, San Diego, Calif., August 11-14.

• **Western Electronic Show & Convention**—Cow Palace, San Francisco, Calif., Aug. 18-21.

International Association of Electrical Inspectors—Northwestern Section, Seattle Hotel, Seattle, Wash., Aug. 24-26; Southwestern Section, Flamingo Hotel, Santa Rosa, Calif., Aug. 31-Sept. 2.

• **International Association for Hydraulic Research**—Eighth Congress, Montreal, Canada, Aug. 24-28.

• **Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers**—Statler Hotel, Boston, Mass., Aug. 31-Sept. 2.

SEPTEMBER

Illuminating Engineering Society—Annual National Technical Conference, Fairmont and Mark Hopkins Hotels, San Francisco, Calif., Sept. 7-11.

Maryland Utilities Association—Annual Fall Conference, The Cavalier, Virginia Beach, Va., Sept. 11-12.

National Electrical Contractors Association—Annual Convention, Waldorf Astoria Hotel, New York City, Sept. 13-17.

Edison Electric Institute—EEI-AGA Accounting Division & Section Organization Meeting, Hotel Cleveland, Cleveland, Ohio, Sept. 14-15; Meter and Service Committee, Hotel Wentworth, Portsmouth, N. H., Sept. 14-16; Industrial Power & Heating Group, Treadway Inn, Niagara Falls, N. Y., Sept. 17-18; Industrial Relations Committee Twelfth Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 21-23.

Electric Companies Public Information Program—Workshop Conference, Warwick Hotel, Philadelphia, Pa., Sept. 16-17.

Northwest Public Power Association—Power Use Workshop, Ephrata, Wash., Sept. 16-18; Accounting and Financing Workshop, Clark County PUD community room, Vancouver, Wash., Sept. 30-Oct. 1.

Public Utilities Association of the Virginias—41st Annual Meeting, The Greenbrier, White Sulphur Springs, West Va., Sept. 17-19.

Instrument Society of America—14th Annual Conference and Exhibit, International Amphitheatre, Chicago, Ill., Sept. 20-25.

Third Industrial Nuclear Technology Conference—Sponsored by the Armour Research Foundation and Nucleonics magazine, Morrison Hotel, Chicago, Ill., Sept. 22-24.

Special Technical Conference on Non-linear Magnetics and Magnetic Amplifiers—Fourth Annual Meeting, sponsored by AIEE and ERE, Shoreham Hotel, Washington, D. C., Sept. 23-25.

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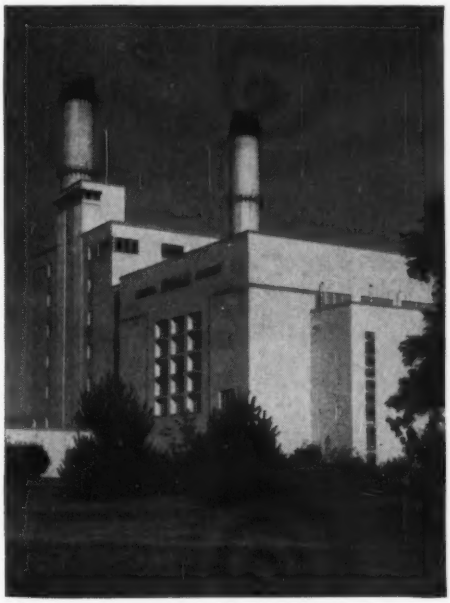

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